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STABILITY STUDY OF NANTICOKE ASH DYKES

Report No 85-303-K

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ABSTRACT

A slope stability study has been carried out to provide guidelines for the safe positioning of a dragline on a fly ash dyke in respect to its distance to the edge of the dyke and for the safe operation of ash dumping trucks on an ash dyke. The method of analysis and recommendations for these operations are presented in this report.

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To Mr. W.G. Lobban
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STABILITY STUDY OF
NANTICOKE ASH DYKES

1.0 INTRODUCTION

In July 1985, a slide failure occurred in the ash bank at the Nanticoke ash lagoon site (see F1 in Figure 1) during an ash dumping operation by trucks. In the same month, an ash dyke failed when a dragline was dredging ash from a secondary ash cell (see F2 in Figure 1). Subsequently, staff of the Soil Sciences Section were asked to provide guidelines for the positioning of the dragline on a dyke in respect to its distance to the dyke edge and for the safe operation of ash dumping trucks. Also, recommendations for the construction of temporary roads in the secondary cell were required.

In this project, first a site investigation to determine the relative strength of the ash was carried out at the ash lagoon site. Then a slope stability analysis was carried out with the information obtained from the field. Guidelines and recommendations were obtained by carrying out a parametric study of the factors affecting the stability of an ash slope.

In this report, results from the field study, computer analysis and recommendations are presented.

2.0 FIELD INVESTIGATION

The field investigation was carried out at the dykes adjacent to the existing ash cells and at the area where two dump trucks slid down the ash bank. Figure 1 is an oblique airphoto of the lagoon site taken in August, 1985 and Figure 2 is a vertical airphoto of the site taken in April, 1985. The slightly different appearance of the cells and the ash dumping area in these photographs was the result of ash dredging and dumping operations. The field investigation program consisted of performing a large number of cone penetration tests at the ash dykes, installing two piezometers at the dyke between settling cells No 2 and No 3 and measuring the slope inclination of existing dykes. The penetration tests involved driving 2-inch diameter steel cones with a 140 lb hammer. These were done for the purpose of identifying the relative strength of the ash layers within the dykes. The locations of the penetration holes are marked in Figure 3 and individual cone test results are plotted and included in the Appendix.

In Figure 4, the penetration test results are used to demarcate the zones of ash of different strength.

3.0 ANALYSES

Slope stability calculations were performed on a computer to obtain guidelines regarding the safe position for a dragline to operate on an ash dyke during a dredging operation. Also general guidelines were required for the ash dumping operation by trucks to avoid slope failure. These two tasks will be described and the results will be presented.

3.1 Guidelines for Draglines

A number of factors affect the stability of a dyke slope. These are: the slope inclination, the water pressure outside and within the slope, shear strength of the dyke material and external loading conditions. A number of assumptions had to be made in this two-dimensional stability analysis using Bishop's simplified circular arc method/1/. The dyke failure involving a dragline was used to check the strength assumption and the dragline loading assumption. Figure 5 shows the cross-section of the dyke near the failure site. The slope inclination and the water level shown were determined at the time of the field investigation. The short vertical section above the external water level was caused by erosion of the ash by water. On the basis of the cone penetration results, the ash in the dyke was divided into two zones: an upper crust of 5 ft of better compacted ash and an underlying layer of less compacted ash. The assignment of $\phi' = 35°$ to the crustal material and $\phi' = 28°$ to the underlying ash seemed reasonable according to literature data and past experience. With the assumed ϕ' values and $c' = 0$, stability calculations were performed assuming: (1) the dragline load was distributed on two pads ("pad loading") and (2) the dragline load was evenly distributed over the whole width of the dragline ("uniform loading"). Two conclusions were obtained from this exercise: (1) the assumptions of "uniform loading" and "pad loading" gave almost identical factors of safety (F.S.) for the slope and (2) the assumption of a tension crack in the assumed failure arc did not change the calculated factor of safety. After studying the sensitivity of various parameters affecting the F.S. of the slope section as shown in Figure 5, it was felt that an apparent cohesion (c') value should be assigned to the ash because of the suction (negative pore water pressure) in the ash. After several trials, a factor of safety of about 1 was obtained for the dyke section as shown in Figure 5 with the following assumptions:

(1) Upper 5 ft ash, $\phi' = 35$, $c' = 100$ psf, $\gamma = 90$ pcf
lower ash, $\phi' = 28°$, $c' = 100$ psf, $\gamma = 90$ pcf

(2) External loading from a "medium weight" dragline (see Table I for information about this equipment) positioned 5 ft from the edge of the slope (ie offset distance = 5 ft).

(3) Adjustment of the calculated factor of safety in a two-dimensional analysis due to the three-dimensional effect of the failure surface.

To provide guidelines for the position of a dragline to perform dredging on a dyke, an extensive stability analysis was done for 3 types of draglines. Information pertaining to these draglines is summarized in Table I.

Figures 6 and 7 show the effect of slope inclination and offset distance on the stability of an ash dyke when a "heavy weight" dragline or a "light weight" dragline is placed on the dyke during ash dredging. Note that in the analysis for the "heavy weight" dragline, it was assumed that 60% of the load was on one pad and 40% was on the other pad. However, in the case of the "light weight" dragline, 100% of the load was on the pad nearer to the edge of the dyke due to temporary uplifting of the pad farther away from the edge of the dyke during the dredging operation. Because of these assumptions, the effect of dragline loading on the stability of the dyke is almost identical for these 2 draglines. Also note that as the "offset distance" is increasing to a certain value, the effect of dragline loading on the dyke stability becomes zero. Figures 8 and 9 show the effect of "offset distance" and "slope inclination" on the stability of an ash dyke for the "medium weight" dragline.

From the cone penetration test data and results from the slope stability calculations, it may be concluded that the dyke failure involving a dragline could have been caused by the underlying weak ash and the relatively steep slope inclination.

To avoid the combined effect of loading on a dyke by two draglines in operation, it is suggested that the minimum distance between the two draglines should be 10 times the length of a dragline.

3.2 Guidelines for Ash Dumping from Trucks

In July 1985, an ash bank failed at the ash lagoon site when ash was being dumped from trucks. The location of the failure site is shown as Fl in Figure 1. Because there was insufficient information pertaining to the failure, it was not possible to analyze the factors contributing to the failure. In this analysis, an attempt was made to evaluate the factors which can affect the stability of an ash slope during the dumping operation. The assumptions used in the analysis were:

(1) Truck loading - 57,770 lbs (legal load limit), 3 axles

(2) Cross-section (see Figure 10)

(3) Soil properties (see Figure 10)

Again, the two-dimensional Bishop circular arc method was used for the slope stability calculations. The parameters investigated were: the inclination of the slope on which ash is dumped, the $\emptyset'$ value of the ash, and the location of the water level within the slope.

The calculated results are graphically summarized in Figure 10. It can be seen that the water table level in the ash has a significant influence on the stability of the slope. Also, the inclination of the slope and the $\emptyset'$ value have an influence on the stability.

According to the analytical results, it is recommended that the slope on which the ash is dumped should have an inclination flatter than 8 (horizontal) to 1 (vertical). It should be noted that the most critical region is the part of the slope immediately below the rear wheels of the truck. Therefore it is imperative to avoid forming a steep slope in this area because a small slope failure beneath the truck may trigger a larger slide. A bulldozer or suitable equipment should be used to move the dumped ash on the top of the bank to maintain a 8 (horizontal) to 1 (vertical) slope. Furthermore it is important to keep the water level within this slope several feet below the surface. This may be achieved by providing more time for the excess water to drain away from the wet ash. It is recommended that the ash dumping operation be done over a stretch of bank several hundred feet long. No ash dumping should be carried out after a prolonged rainfall and/or snow melt. In the area where trucks are backed up for dumping the ash, the ground surface should be kept fairly dry, and dry bottom ash may be used to fill the wet spots.

3.3. Suggested Procedure for Constructing Temporary Roads in Secondary Settling Cell No 1

Temporary finger roads have been proposed as a means of providing dragline access to the secondary cell for the purpose of dredging. Construction of these temporary roads will have to bridge the elevation difference between the high surrounding dykes and the relatively lower cell bottom. Wet, loose ash deposited by the earlier operation of the lagoon will, by necessity, form the foundation for the finger road embankments. The construction process may also have to deal with a water table near or over the surface of the foundation ash. Some guidelines for construction of temporary finger roads, under these conditions, follow:

1. The first layer - It is important to strive for high quality in the first layer of an embankment because the quality of this layer is often reflected in subsequent layers. Bottom ash in a dry to moist state should be used for this first layer. It should be end dumped on the abutting dyke and pushed into place by a small, lightweight or wide tracked bulldozer. The material should be pushed down the slope and across the cell to avoid a loose pocket at the start of the finger road. The suggested thickness of this layer is 3 to 5 feet. A balance must be struck between producing a layer of minimum thickness, while providing support for the bulldozer and avoiding "sponginess" in the bottom ash fill. The entire surface of this layer should be compacted by the 'dozer tracks'. Construction of this layer in wet weather or with wet material is to be avoided.

2. Subsequent layers - Use of a heavier bulldozer is suggested for placing the embankment fill starting at the second or third lift (depending on field conditions). Fly ash or mixtures of fly ash and bottom ash may be used. Moist fill must be used in order to achieve compaction. The fill should be placed in maximum two-foot layers and thoroughly tracked over by the placing equipment. Equipment compaction should continue until the road surface is no longer dented by the vehicle tracks, unless "sponginess" starts to develop in the fill. After placing the third layer, the quality of compaction may be assessed by running a

fully loaded dump truck over the road surface. Significant rut depth indicates poor compaction and no ruts signify good compaction. Side slopes of 1.5 (horizontal) to 1 (vertical) are recommended for these roads with at least 5 ft of well compacted ash as the "crust". It would be practical to initially overbuild the width of the road and cut back the width of the road with proper side slopes. For a road 10 ft in height, the equipment used to cut back the width of the road should be at least 20 ft from the edge of the road. With this guideline, the equipment should be about 6 ft from the edge of the road after it is cut back with a 1.5 (horizontal) to 1 (vertical) side slope.

3. Corrective measures - If significant rutting occurs in any layer, the ruts should be filled in with new dry material, using the bulldozer, and compaction continued with the loaded trucks. Should wet weather make the top of any layer unworkable, dry bottom ash should be used to form the next layer. Local wet "spongy" areas should be dug out, replaced with dry bottom ash and recompacted after the third layer is completed. Persistent problems should be referred to a soils engineer for site inspection and remedial advice.

4.0 SUMMARY AND RECOMMENDATIONS

In this report, some guidelines were offered for the positioning of a dragline on an existing dyke for the ash dredging operation. Also useful information was obtained to facilitate ash dumping by trucks. Construction procedures were suggested for building temporary roads in the secondary settling cell.

Based on slope stability calculations, the following recommendations are offered for the positioning of a dragline on a dyke for dredging the ash from a cell:

(1) For the "heavy weight" dragline and the "light weight" dragline, the minimum "offset distance" should be at least 6 ft for a slope inclination of 1.5 (horizontal) to 1 (vertical) and a maximum height of slope equal to or less than 15 ft (see Figure 11).

(2) For the "medium weight" dragline, the minimum offset distance is 5 ft for a slope with an inclination of 1.5 (horizontal) to 1 (vertical) with a maximum height of slope equal to or less than 15 ft.

(3) The distance between two operating draglines should be at least 10 times the length of a dragline to minimize the combined loading effect on the dyke slope.

It is further recommended that after a prolonged rainfall or snow melt period, the condition of the ash dykes should be checked. If the slope inclination is steeper than 1.5 to 1, it should be flattened. If there are wet or loose areas on the ash dyke, the ash material should be replaced and recompacted.

For ash dumping by trucks, it is recommended that some practical means be used to control the water level in the slope and the inclination of the slope on which the wet ash is being dumped. The slope on which ash is dumped should be flatter than 8 (horizontal) to 1 (vertical).

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HTC:LM

REFERENCES

1. A.W. Bishop. "The Use of the Slip Circle in the Stability Analysis of Earth Slopes". Geotechnique, Vol 5, pp 7-17, 1955.

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TABLE I

Data Pertaining to Three Draglines Used in Stability Analysis

	"Heavy Weight" Dragline	"Medium Weight" Dragline	"Light Weight" Dragline	Remarks
Total Weight	256,130 lbs	153,000 lbs	110,000 lbs	
Overall Dimensions	20'(L) 17'(W)	18' 4" (L) 16' 4" (W)	17' 5" (L) 11' 4" (W)	
Pad Width	38"	38"	33"	
Pressure on Pad Due to the Weight of Dragline + 10,000 lbs Force Due to Dredging Operation	2105 lb/ft^2	1409 lb/ft^2	1253 lb/ft^2	Load distributed evenly on 2 pads
	2526 lb/ft^2*	1691 lb/ft^2*	1504 lb/ft^2	60% of load on the pad closer to the edge of dyke, 40% of load on the other pad
	4210 lb/ft^2	2818 lb/ft^2	2506 lb/ft^2*	100% of load on the pad closer to the edge of dyke due to uplifting of the other pad during dredging

*used in the dyke stability analyses

FIGURE 1

OBLIQUE AIR PHOTO SHOWING THE ASH CELLS AT THE NANTICOKE ASH LAGOON SITE (PHOTO TAKEN IN AUGUST 1985 FROM THE NORTH SIDE OF THE SITE)

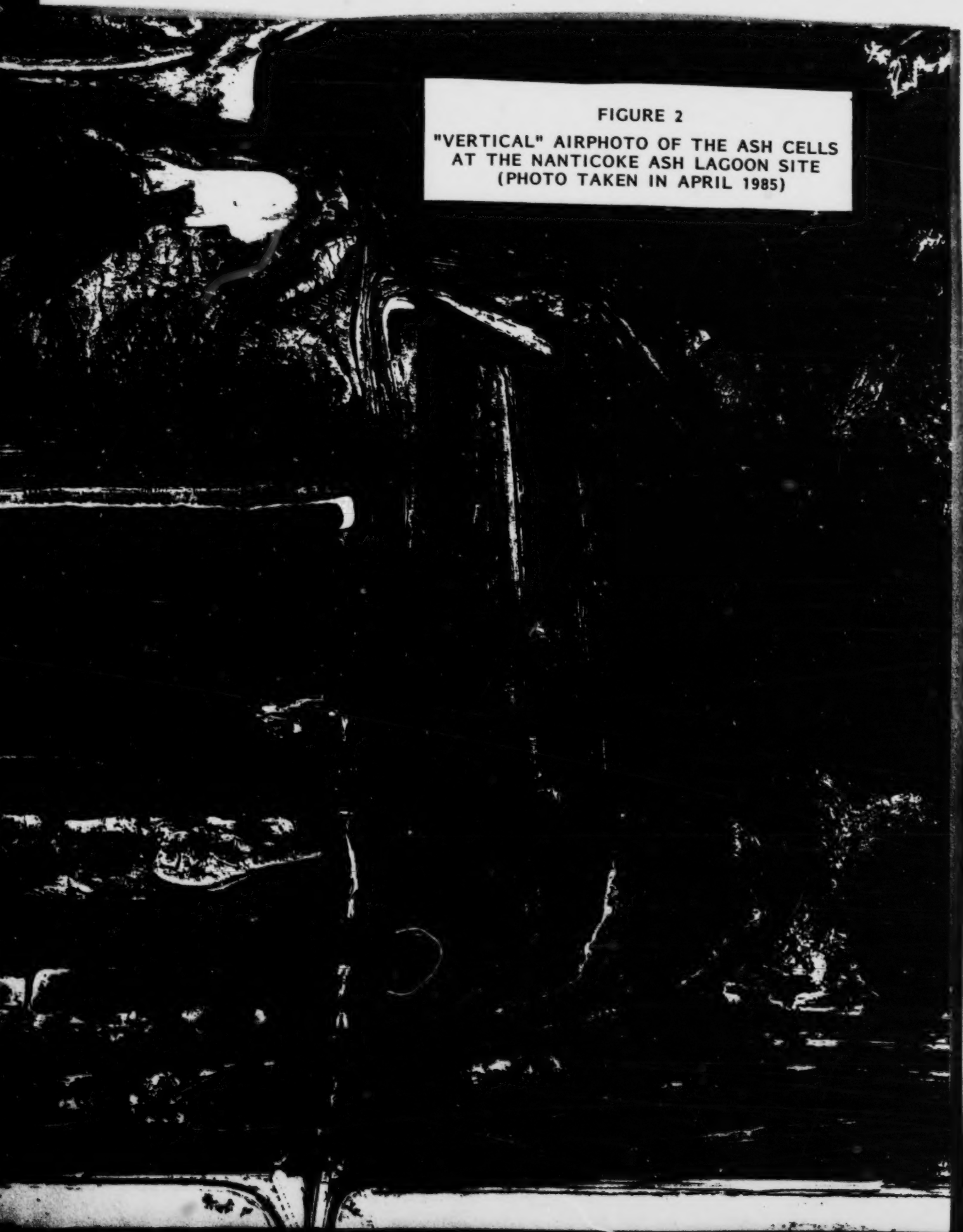


FIGURE 2

"VERTICAL" AIRPHOTO OF THE ASH CELLS
AT THE NANTICOKE ASH LAGOON SITE
(PHOTO TAKEN IN APRIL 1985)

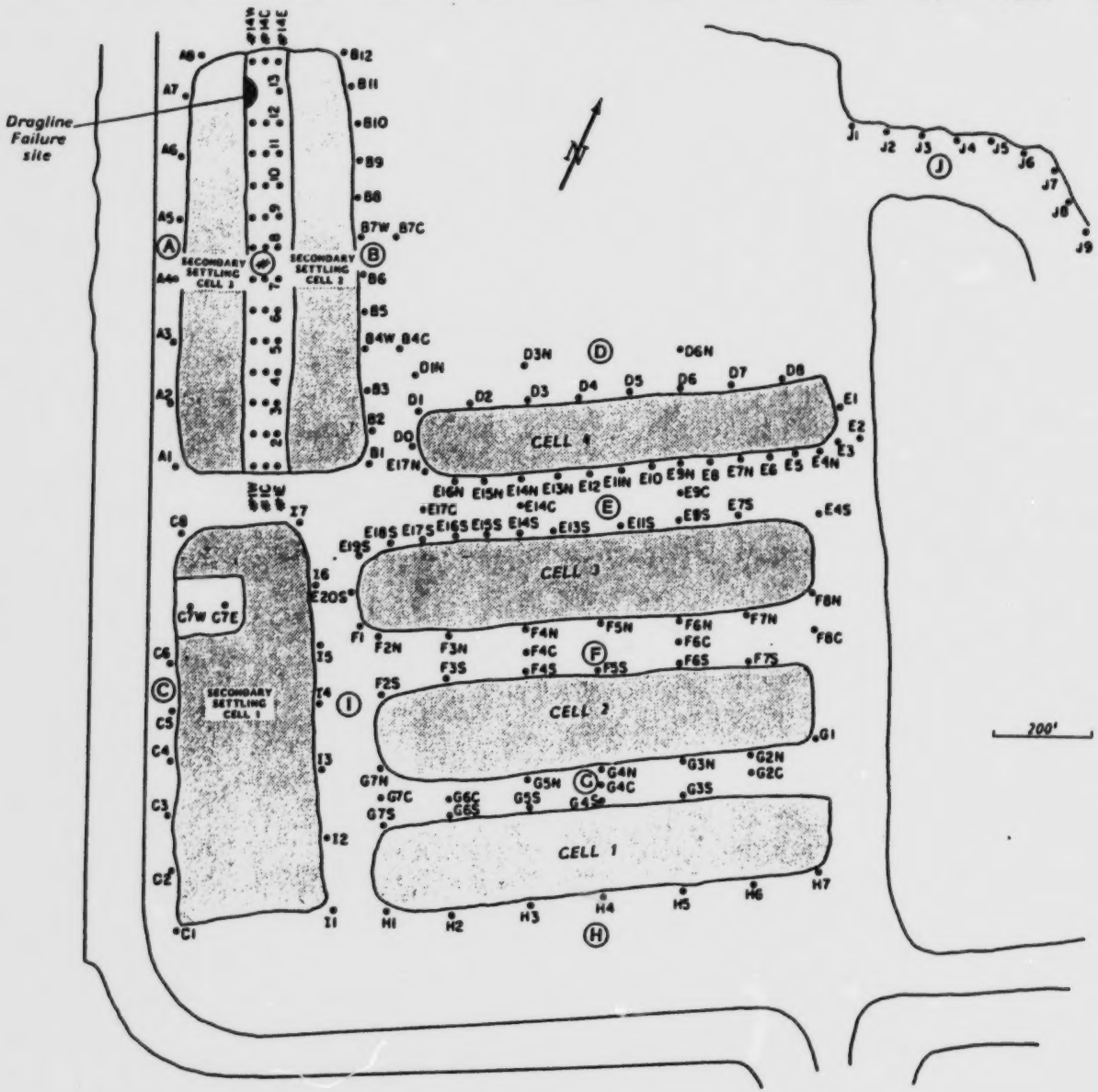


FIGURE 3

LOCATION OF CONE PENETRATION HOLES

200472 RD

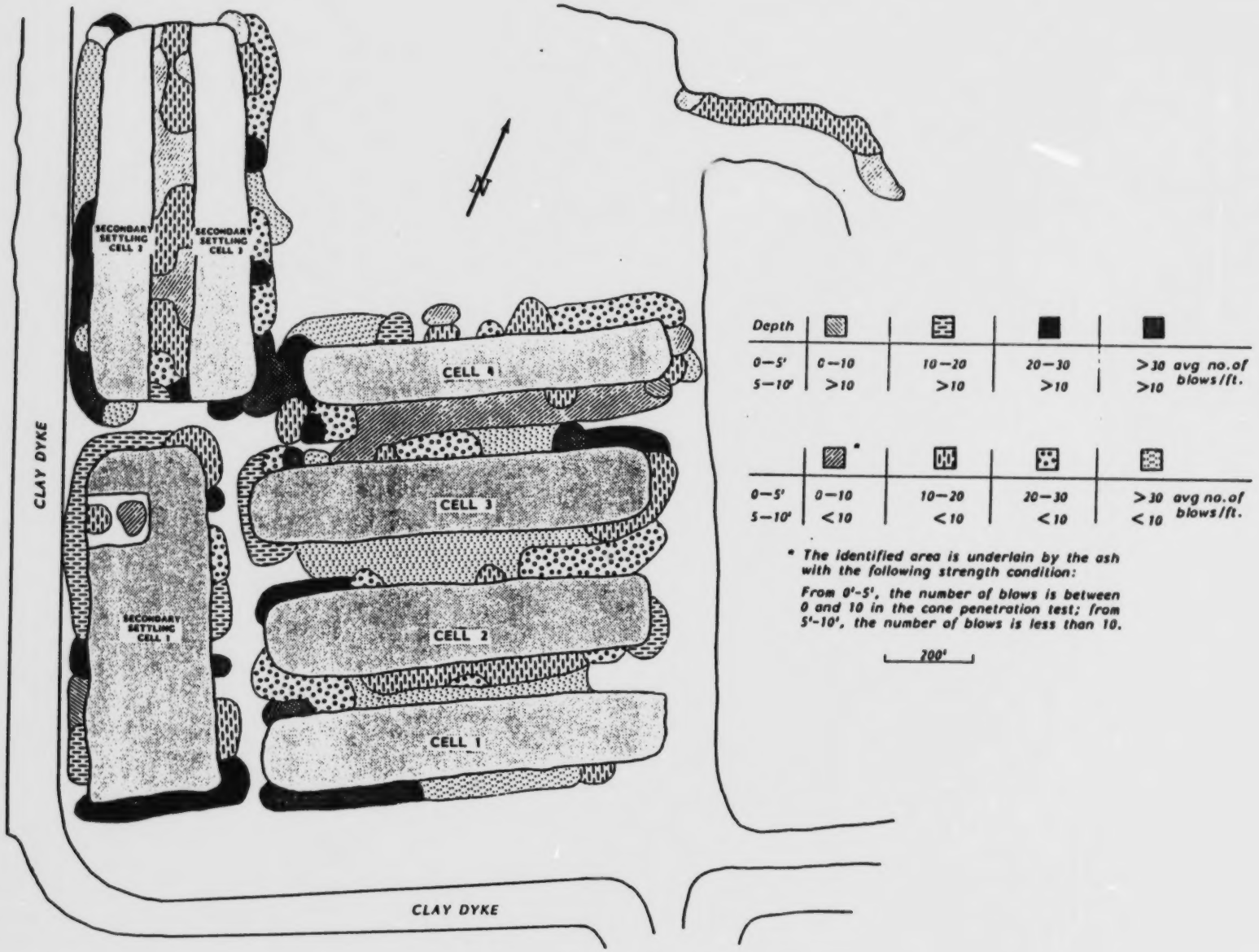


FIGURE 4

DEMARCATION OF ZONES OF ASH
WITH DIFFERENT STRENGTH

200473 RD

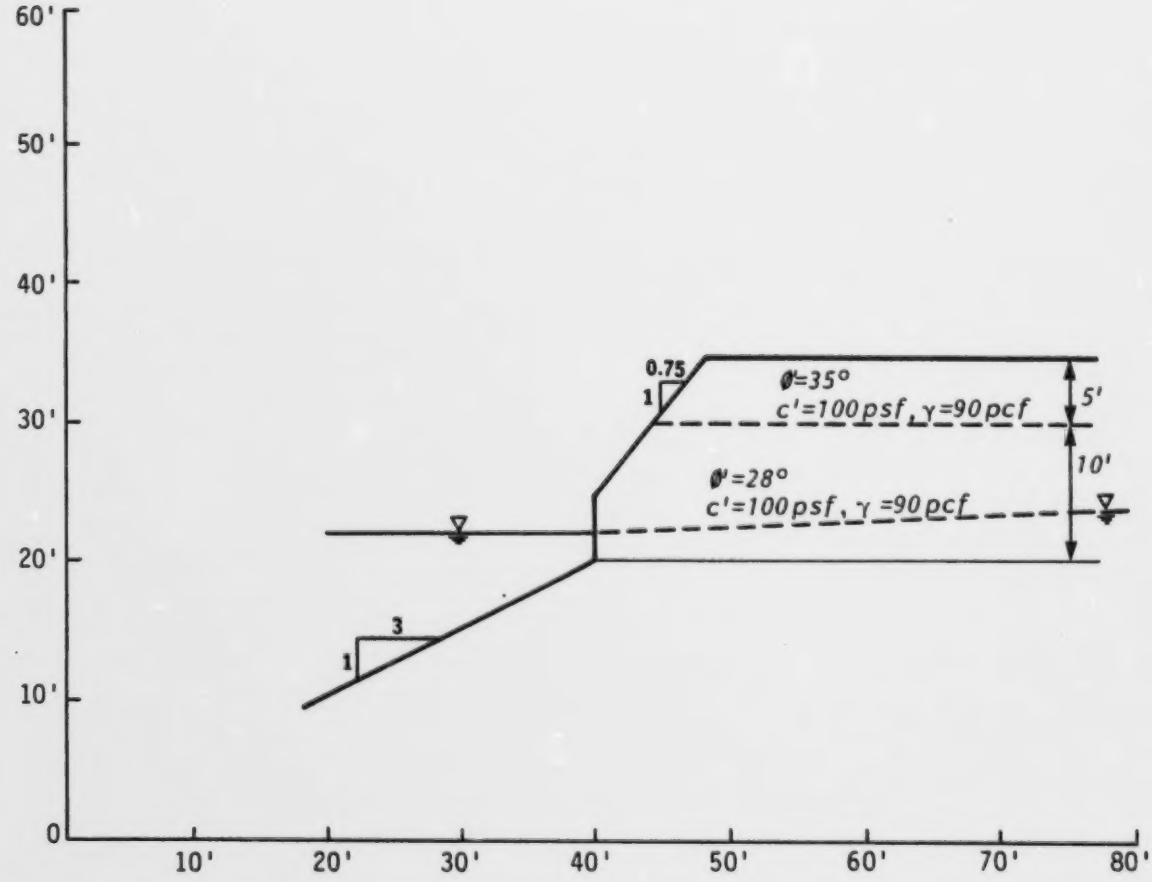


FIGURE 5

CROSS-SECTION OF THE DYKE NEAR THE FAILURE SITE

170172 RD

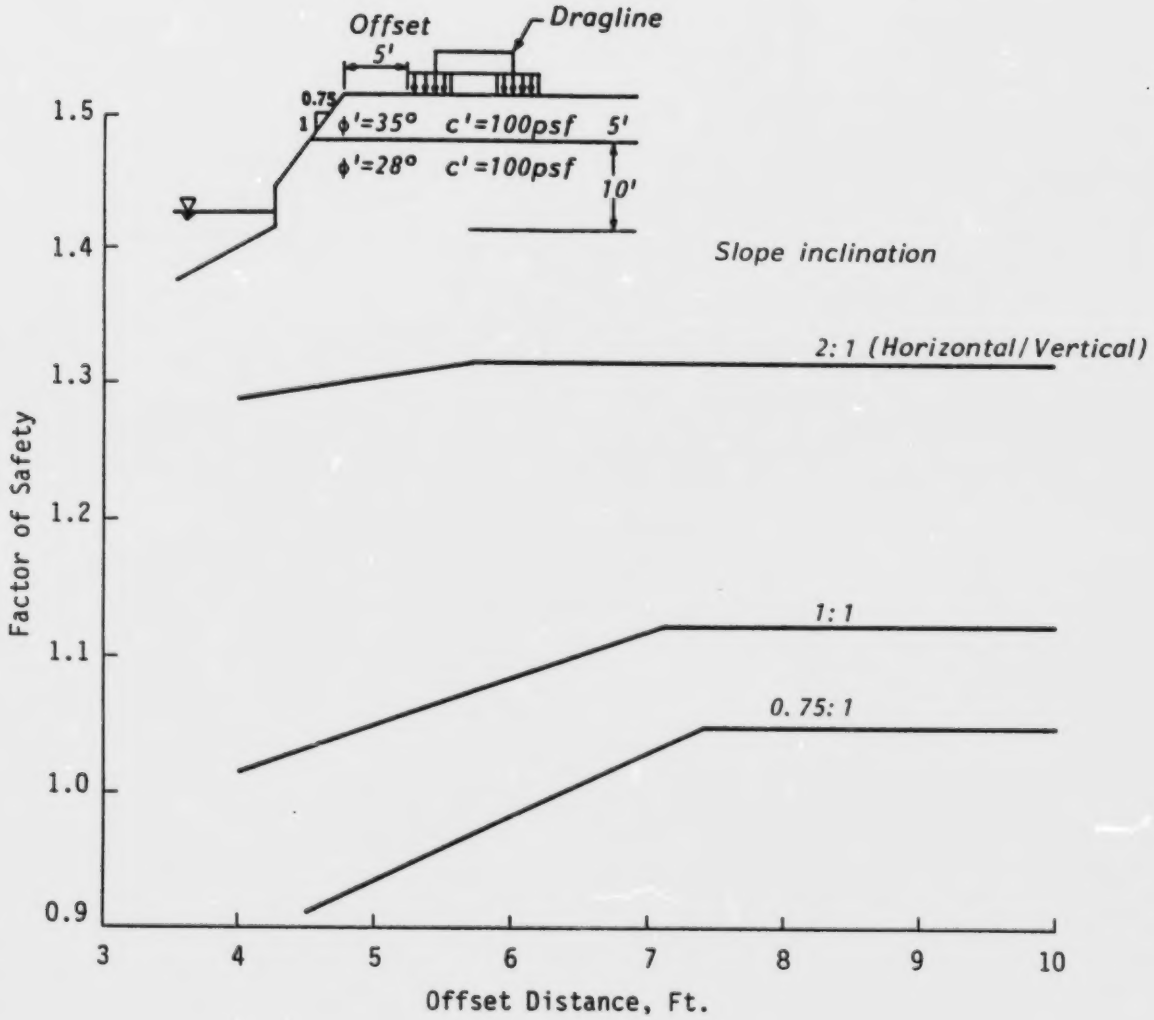


FIGURE 6

THE EFFECT OF SLOPE INCLINATION AND
OFFSET DISTANCE ON THE STABILITY OF ASH DYKE
(FOR "HEAVY WEIGHT" DRAGLINE AND "LIGHT WEIGHT" DRAGLINE)

170173 RD

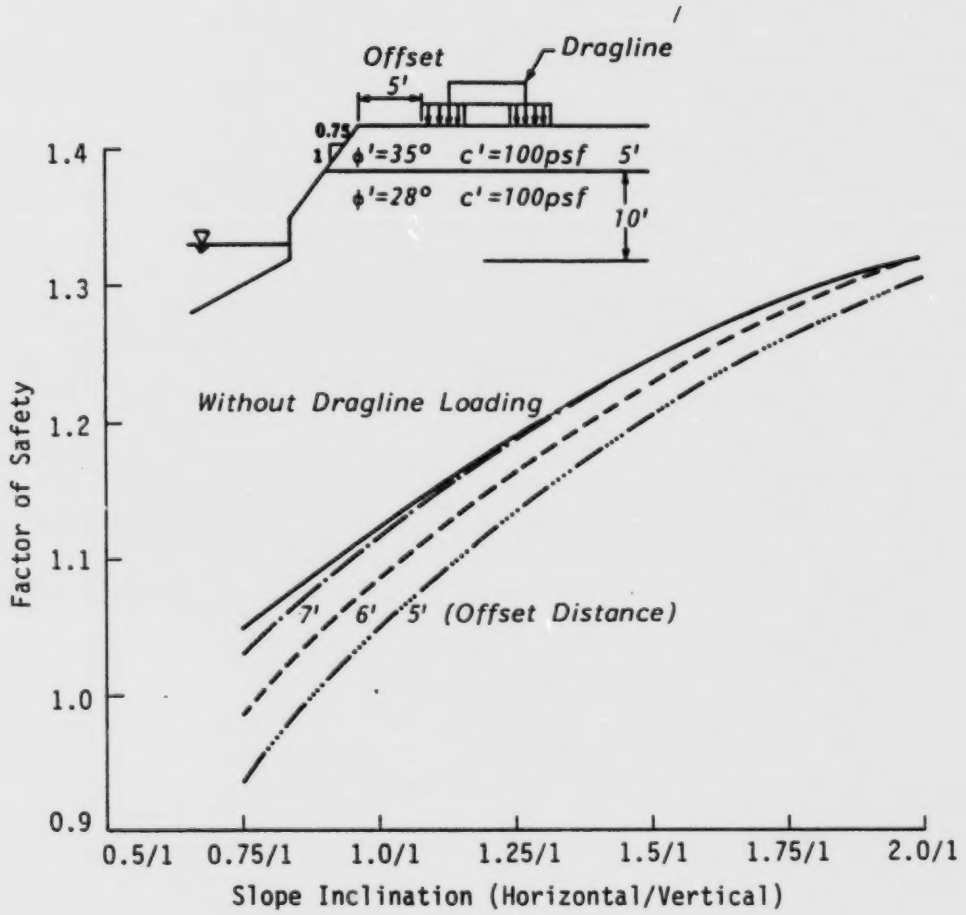


FIGURE 7

THE EFFECT OF OFFSET DISTANCE AND
SLOPE INCLINATION ON THE STABILITY OF ASH DYKE
(FOR "HEAVY WEIGHT" DRAGLINE AND "LIGHT WEIGHT" DRAGLINE)

170174 RD

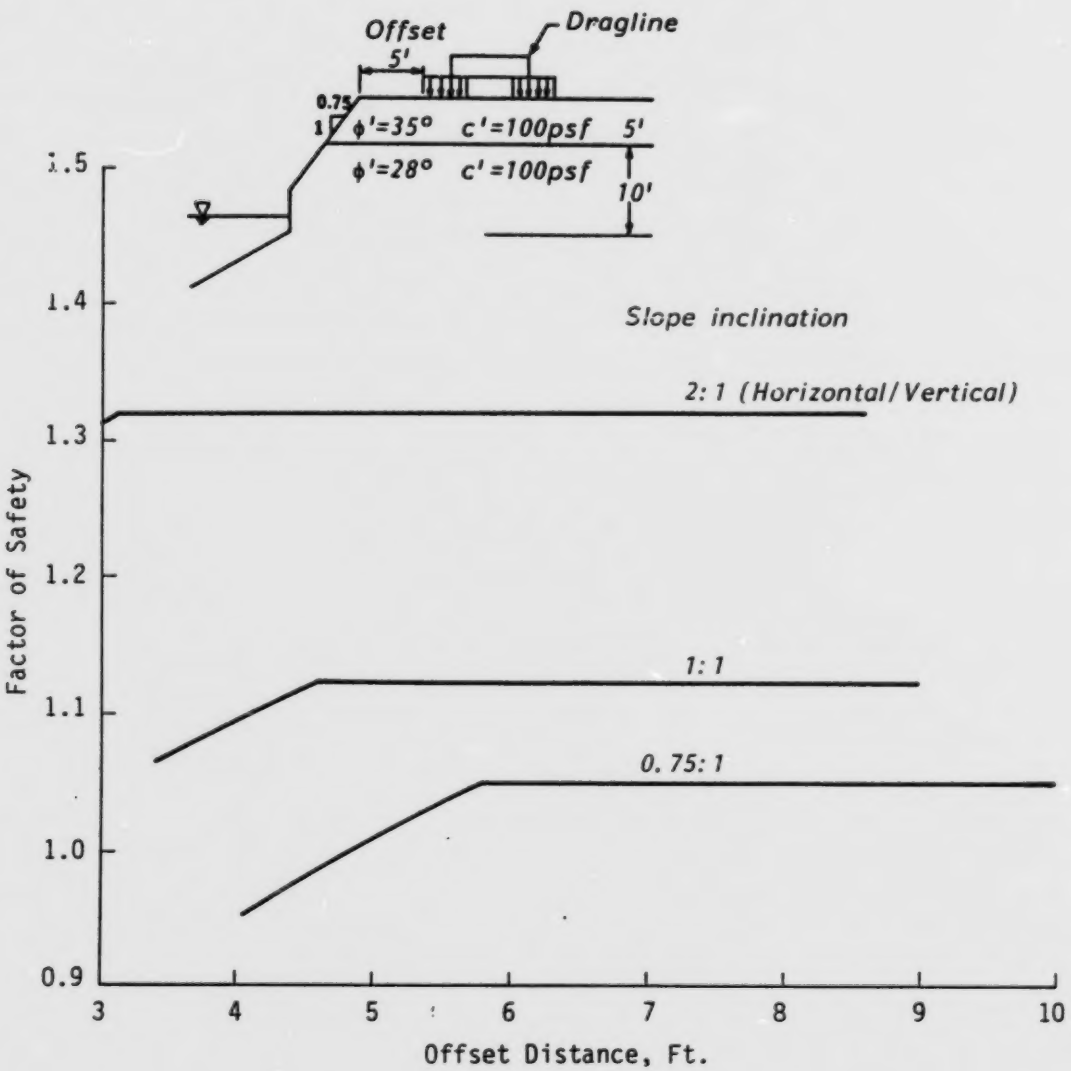


FIGURE 8

THE EFFECT OF SLOPE INCLINATION AND OFFSET DISTANCE ON THE STABILITY OF ASH DYKE (FOR "MEDIUM WEIGHT" DRAGLINE)

170175 RD

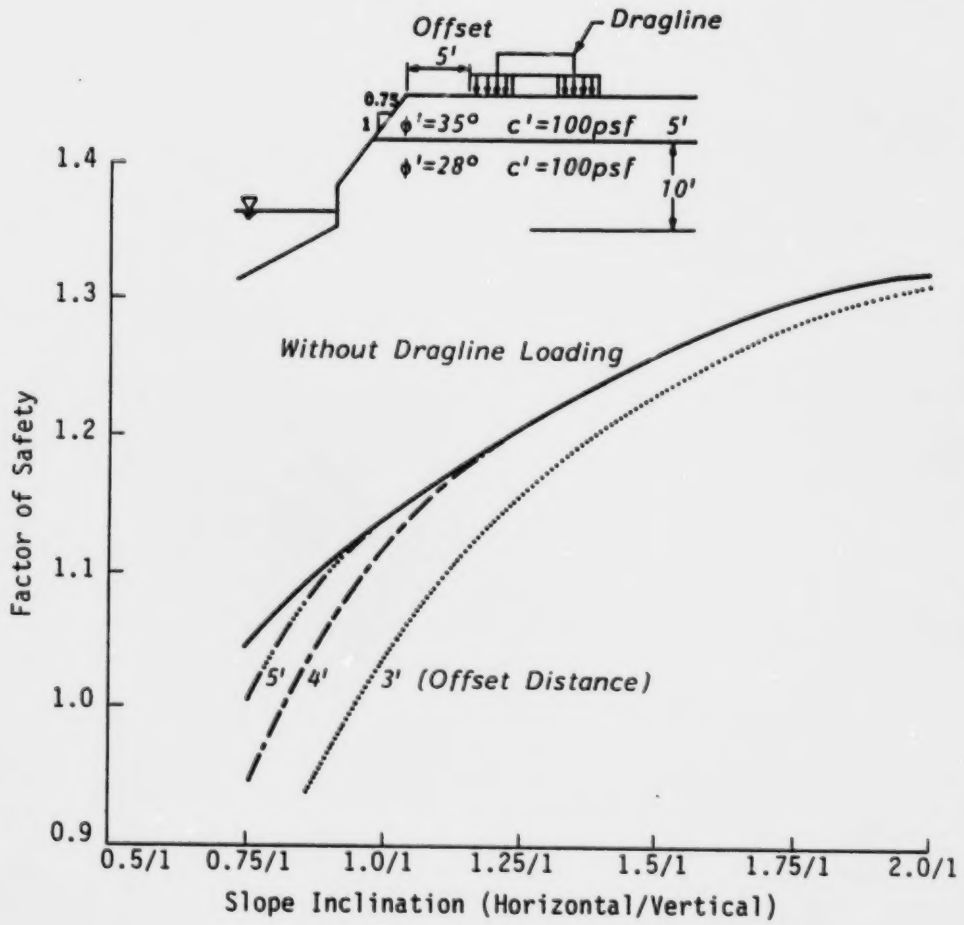


FIGURE 9

THE EFFECT OF OFFSET DISTANCE AND SLOPE INCLINATION ON THE STABILITY OF ASH DYKE (FOR "MEDIUM WEIGHT" DRAGLINE)

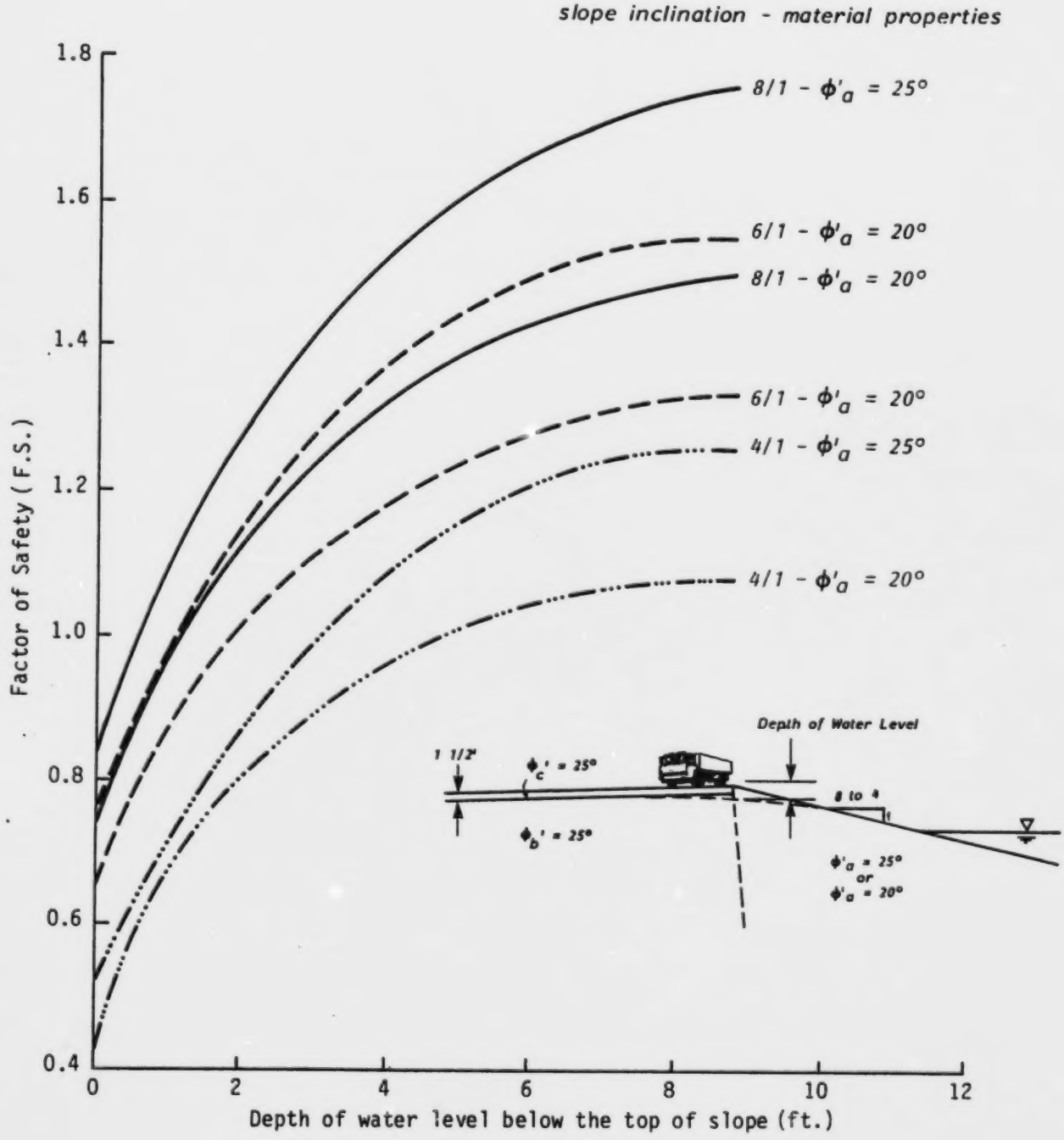


FIGURE 10

THE EFFECT OF SLOPE INCLINATION, WATER LEVEL AND ϕ' ON THE STABILITY OF A SLOPE ON WHICH WET ASH IS BEING DUMPED

170178 RD

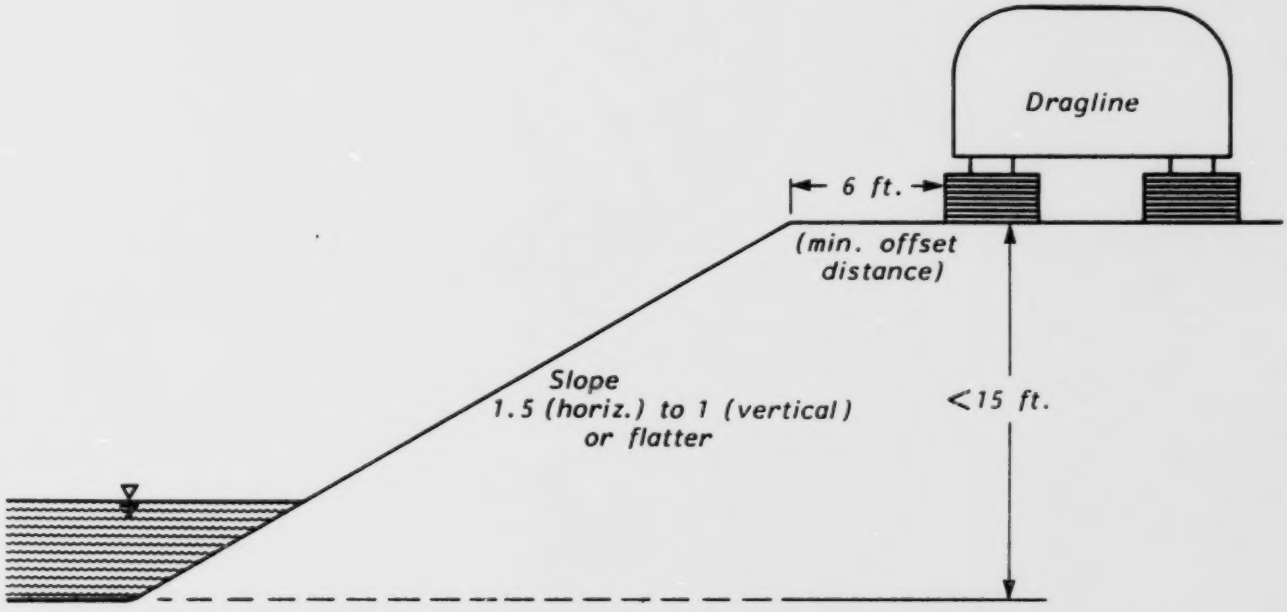
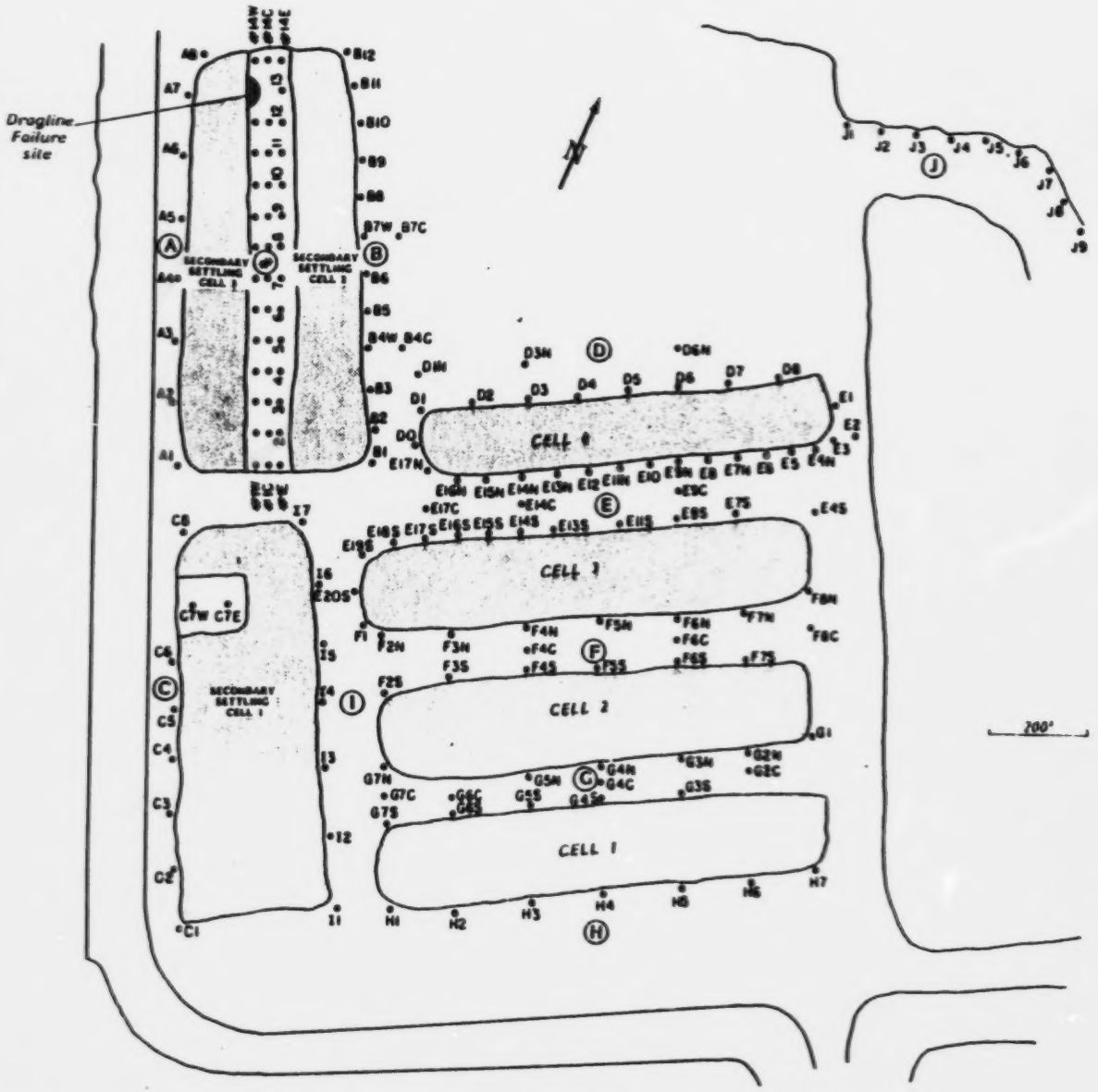


FIGURE 11

RECOMMENDED SIDE SLOPES FOR ASH CELLS AND RECOMMENDED MINIMUM OFFSET DISTANCE FOR THE POSITIONING OF A DRAGLINE DURING DREDGING OPERATION

APPENDIX

CONE PENETRATION DATA



LOCATION OF CONE PENETRATION HOLES

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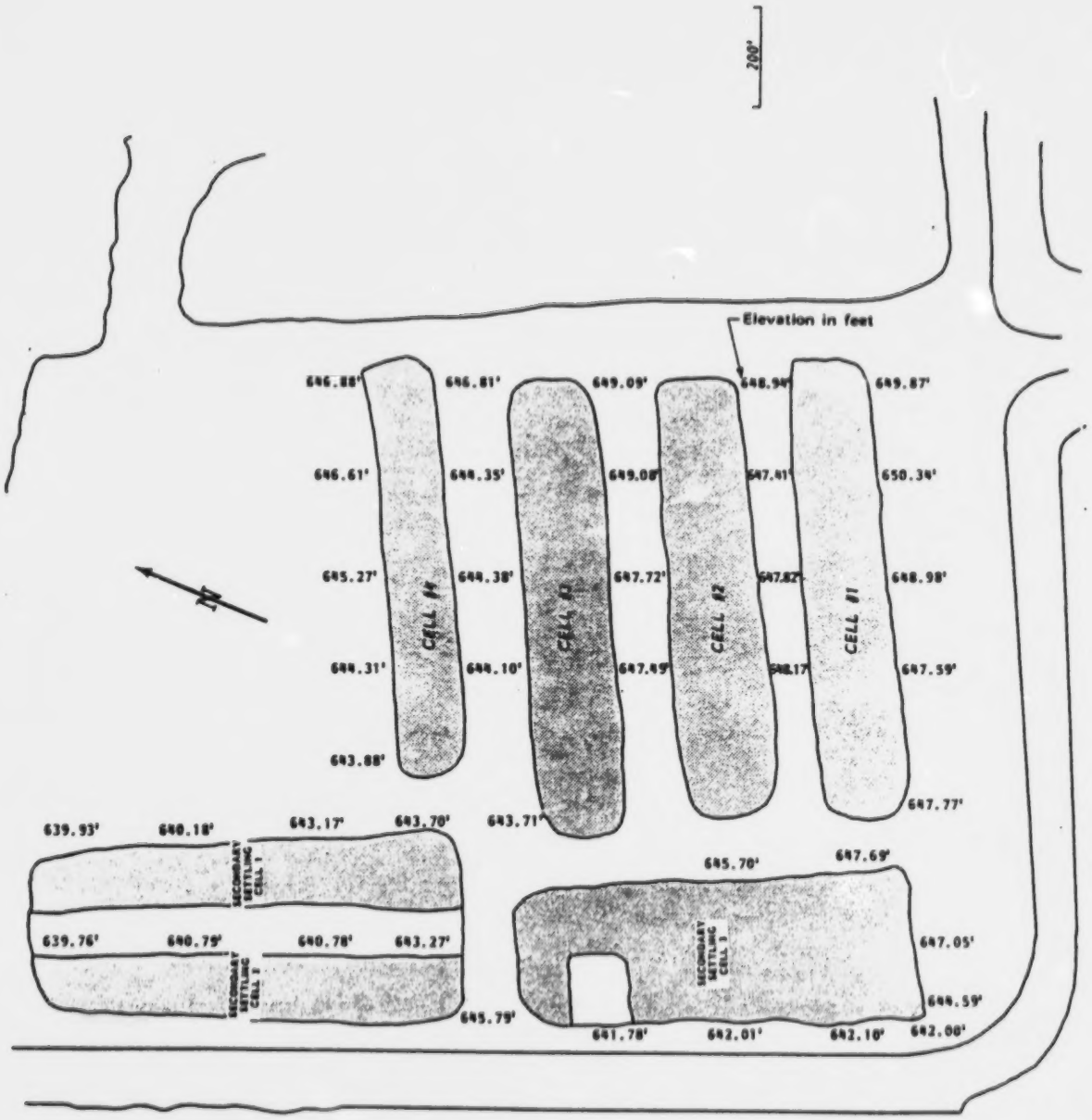
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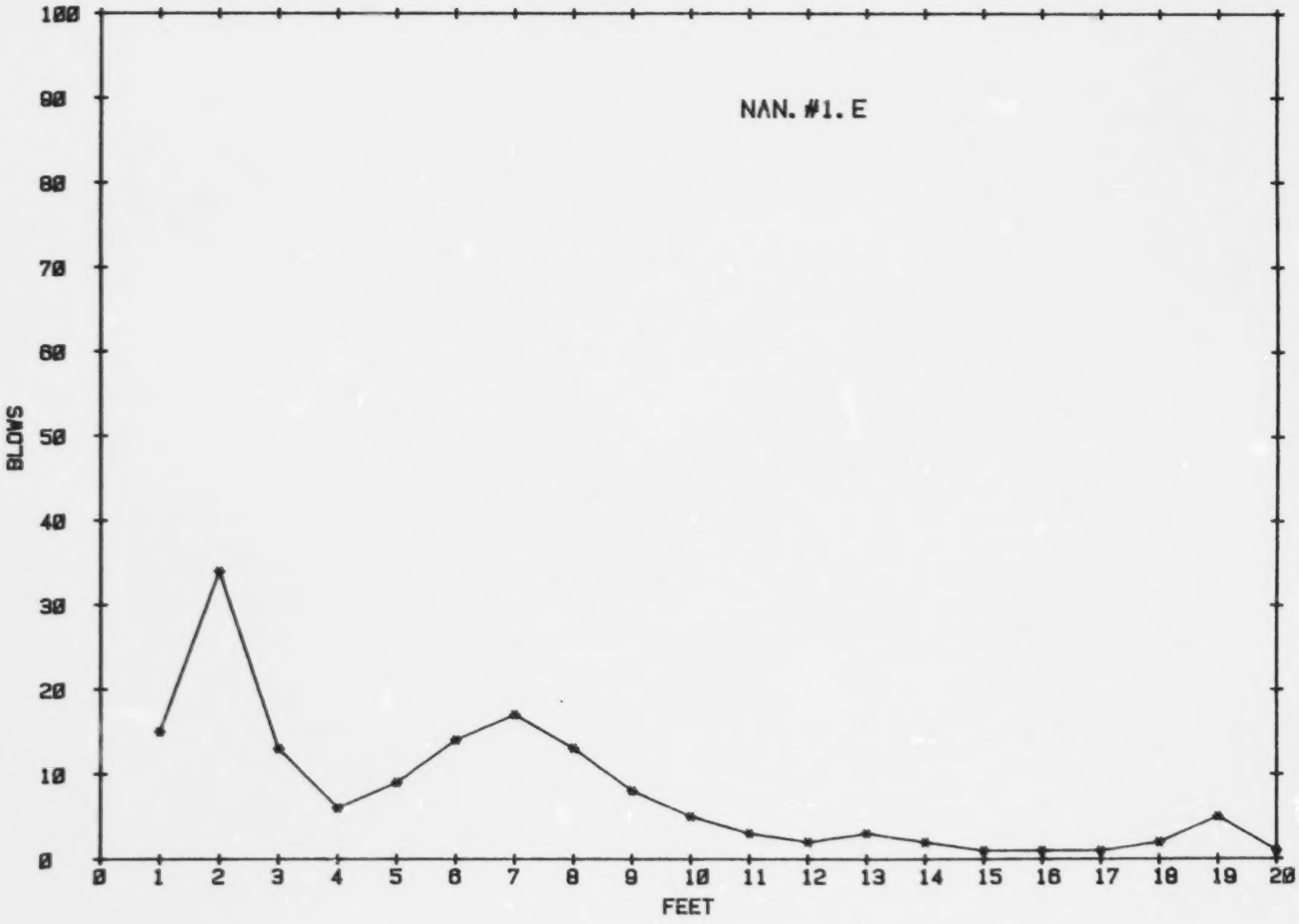
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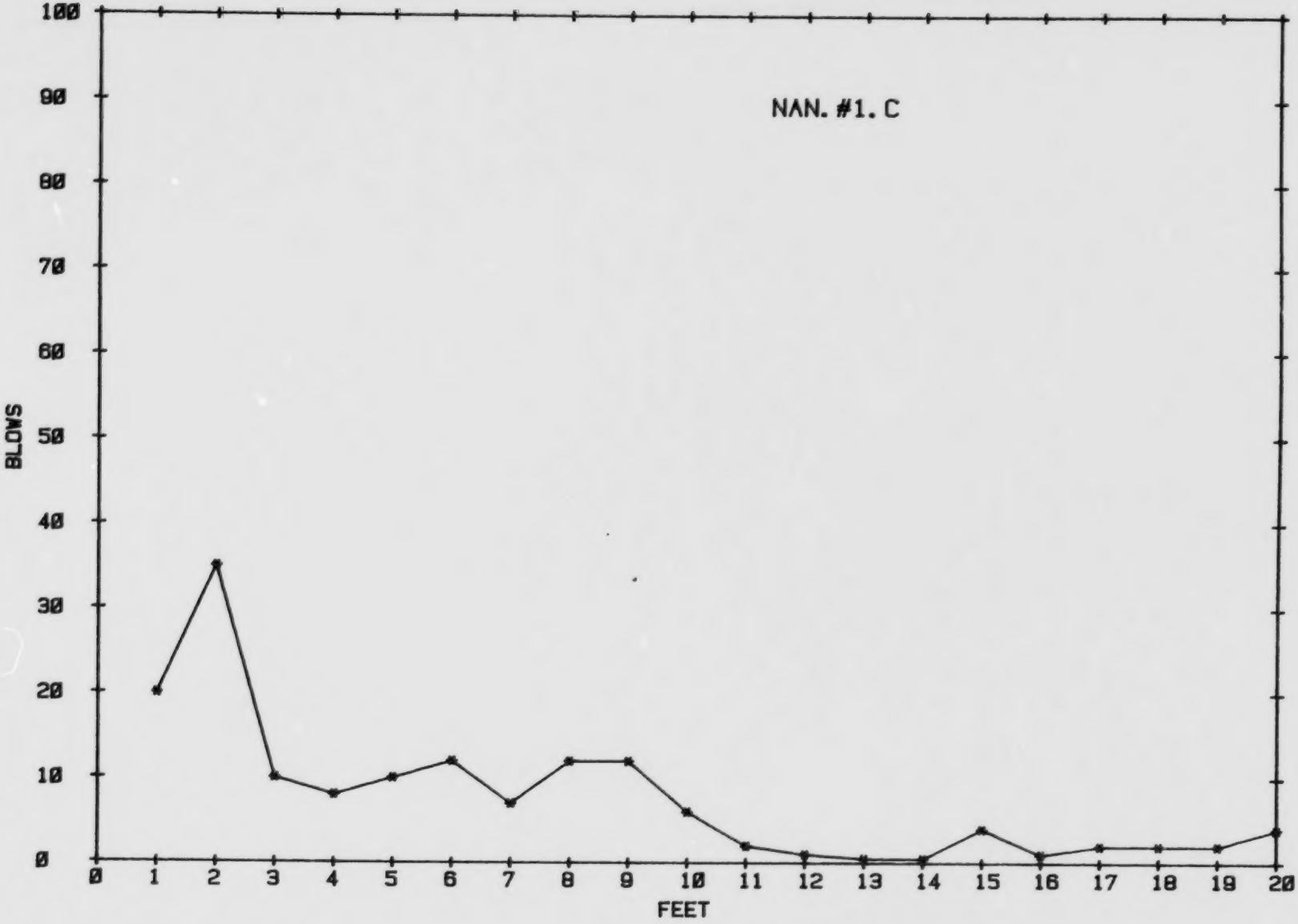
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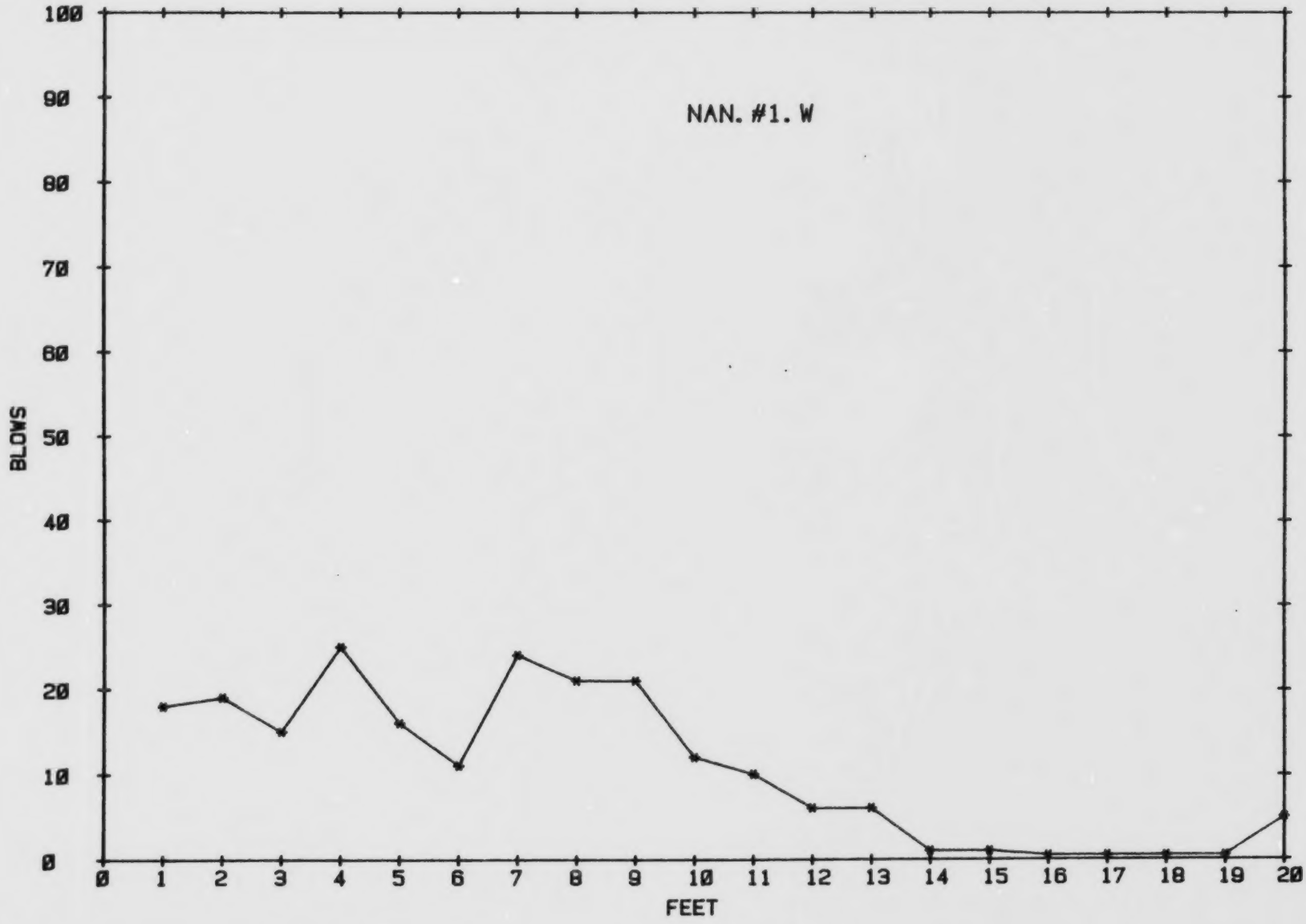
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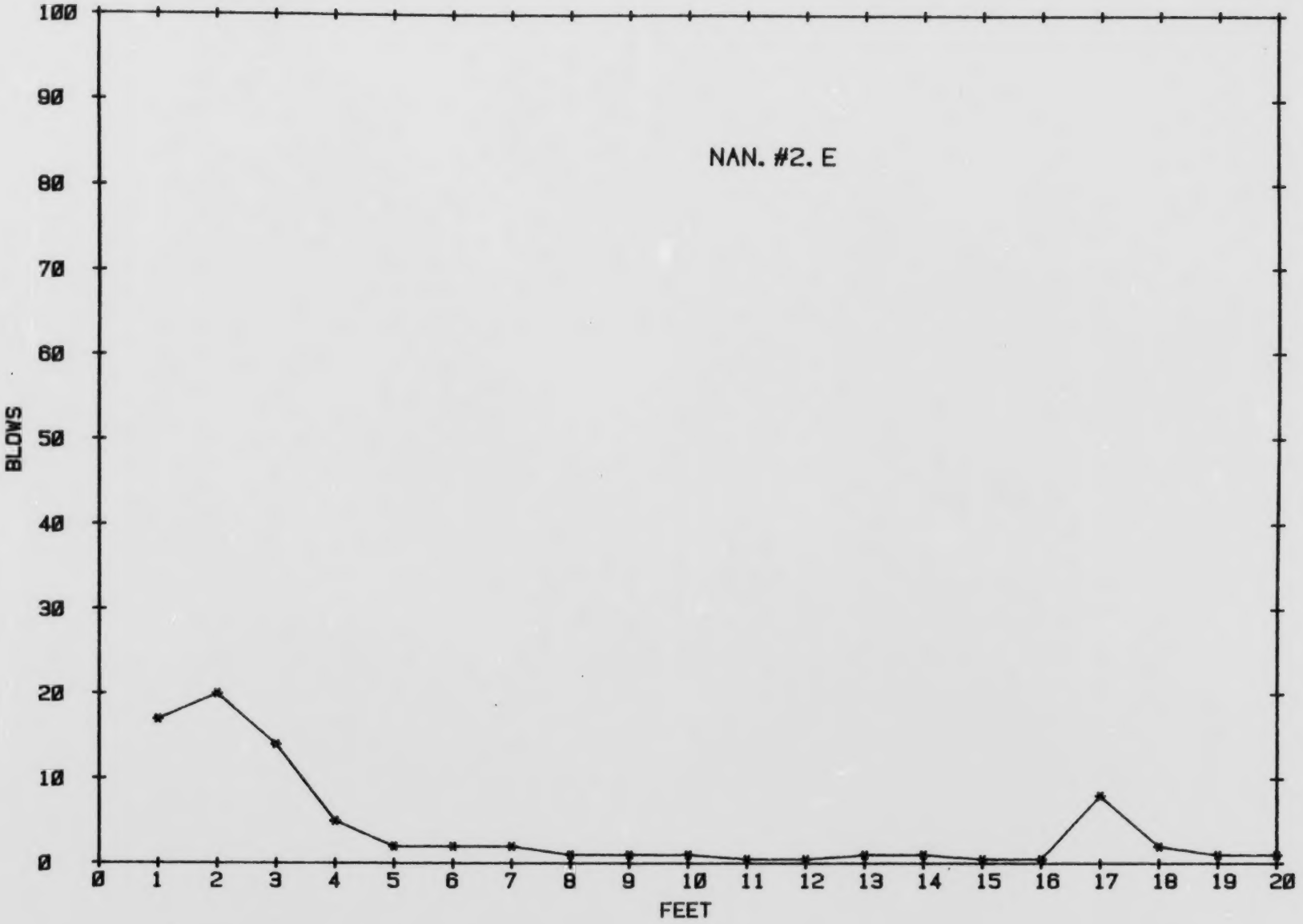
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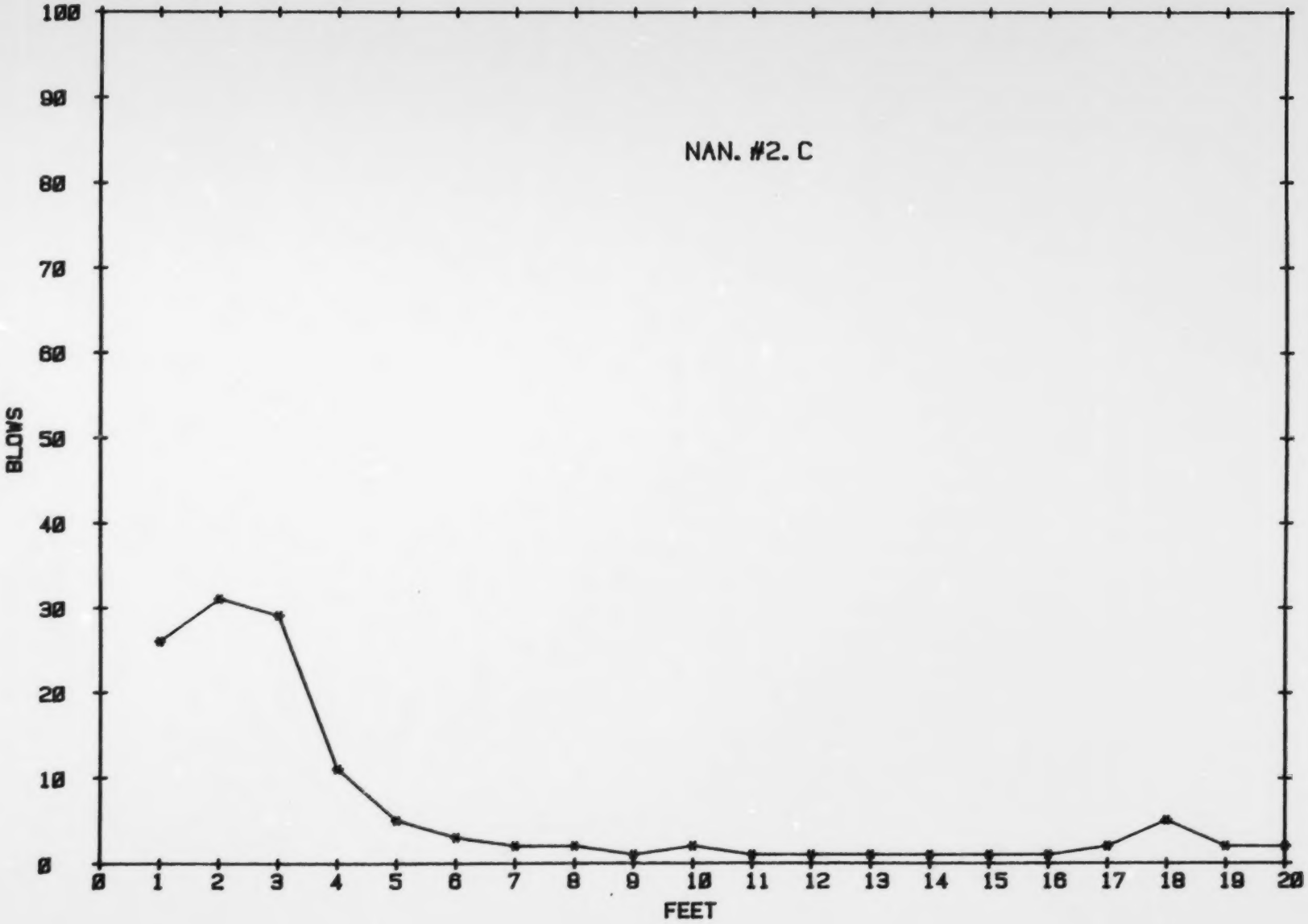
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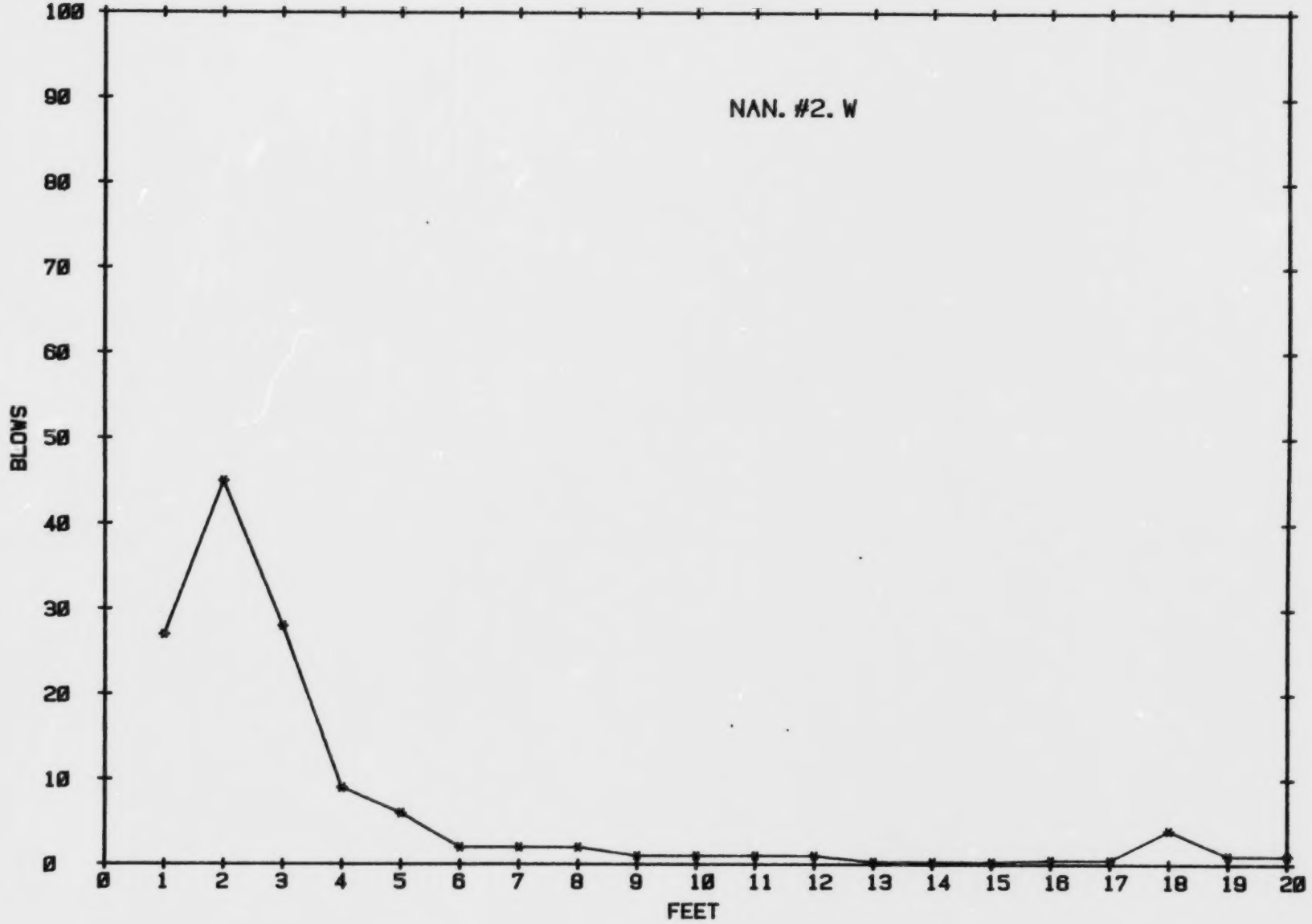
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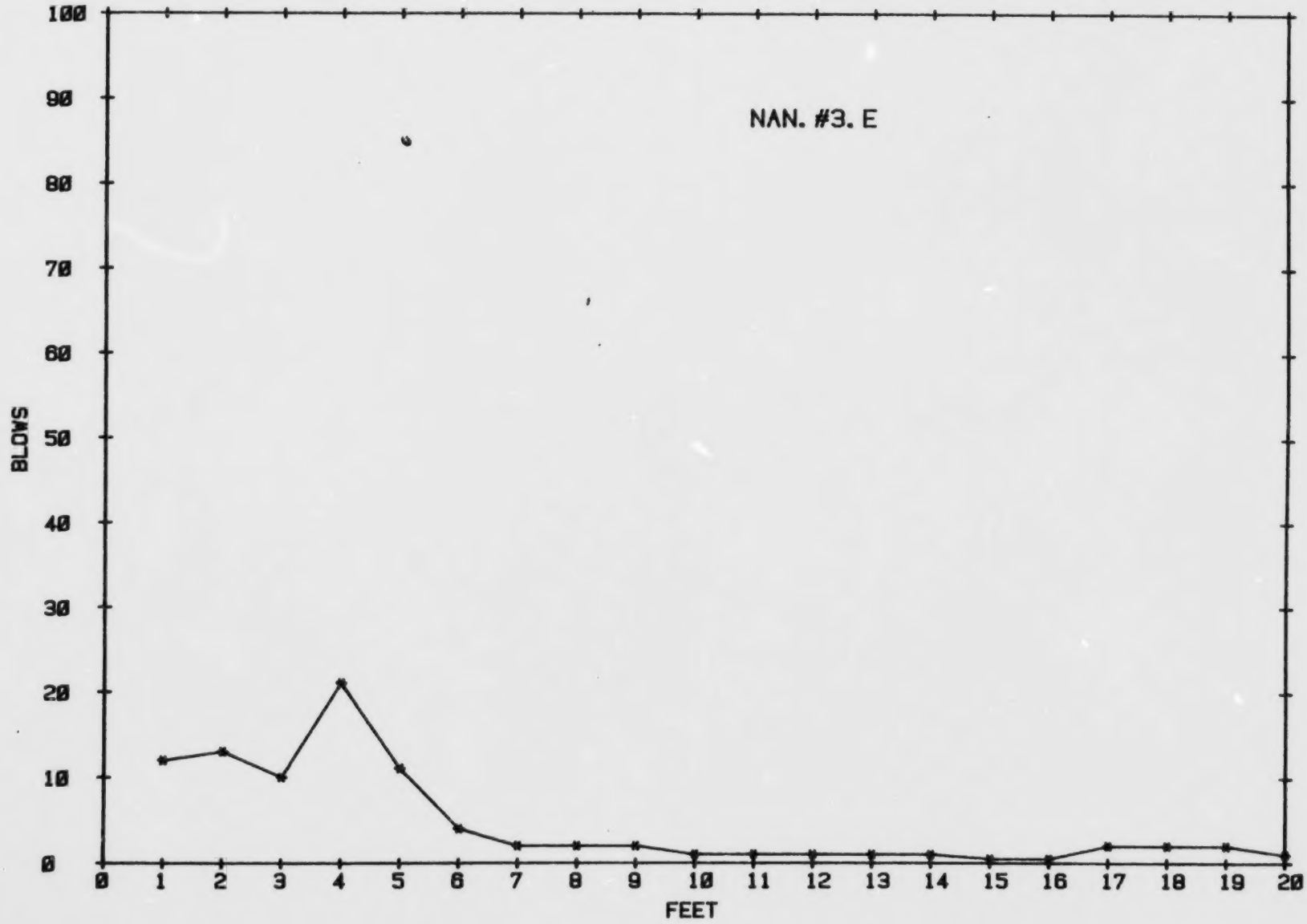
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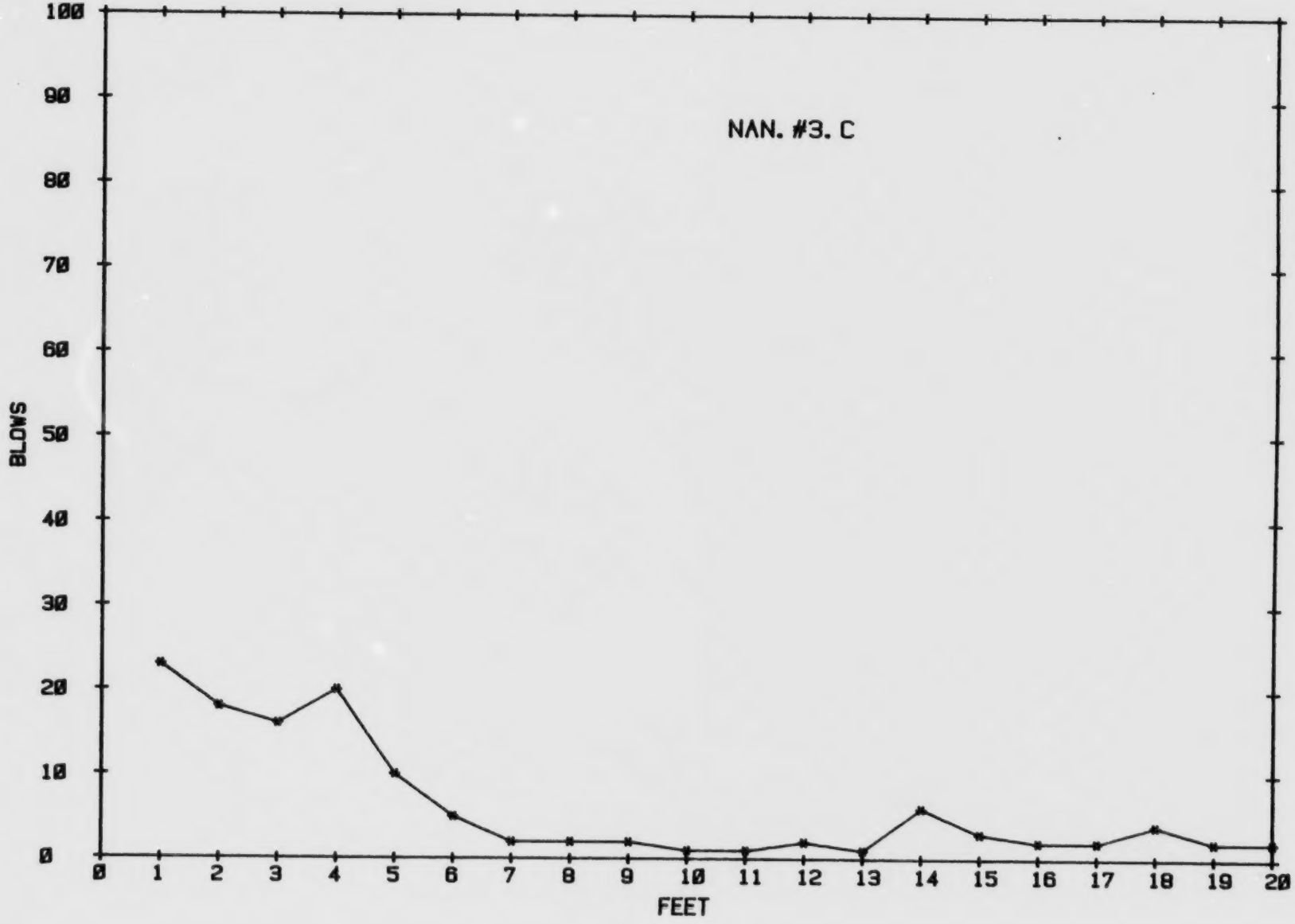
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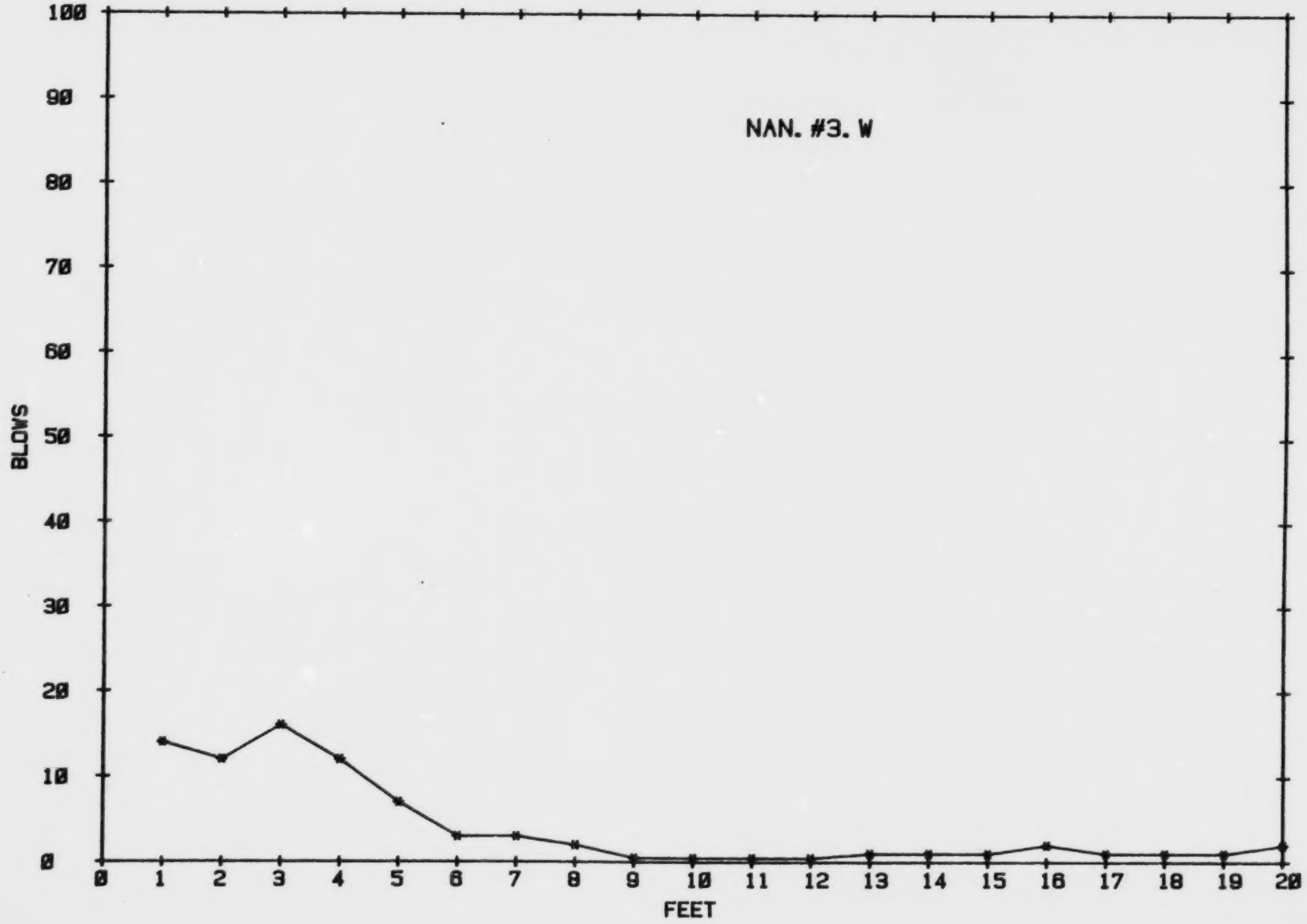
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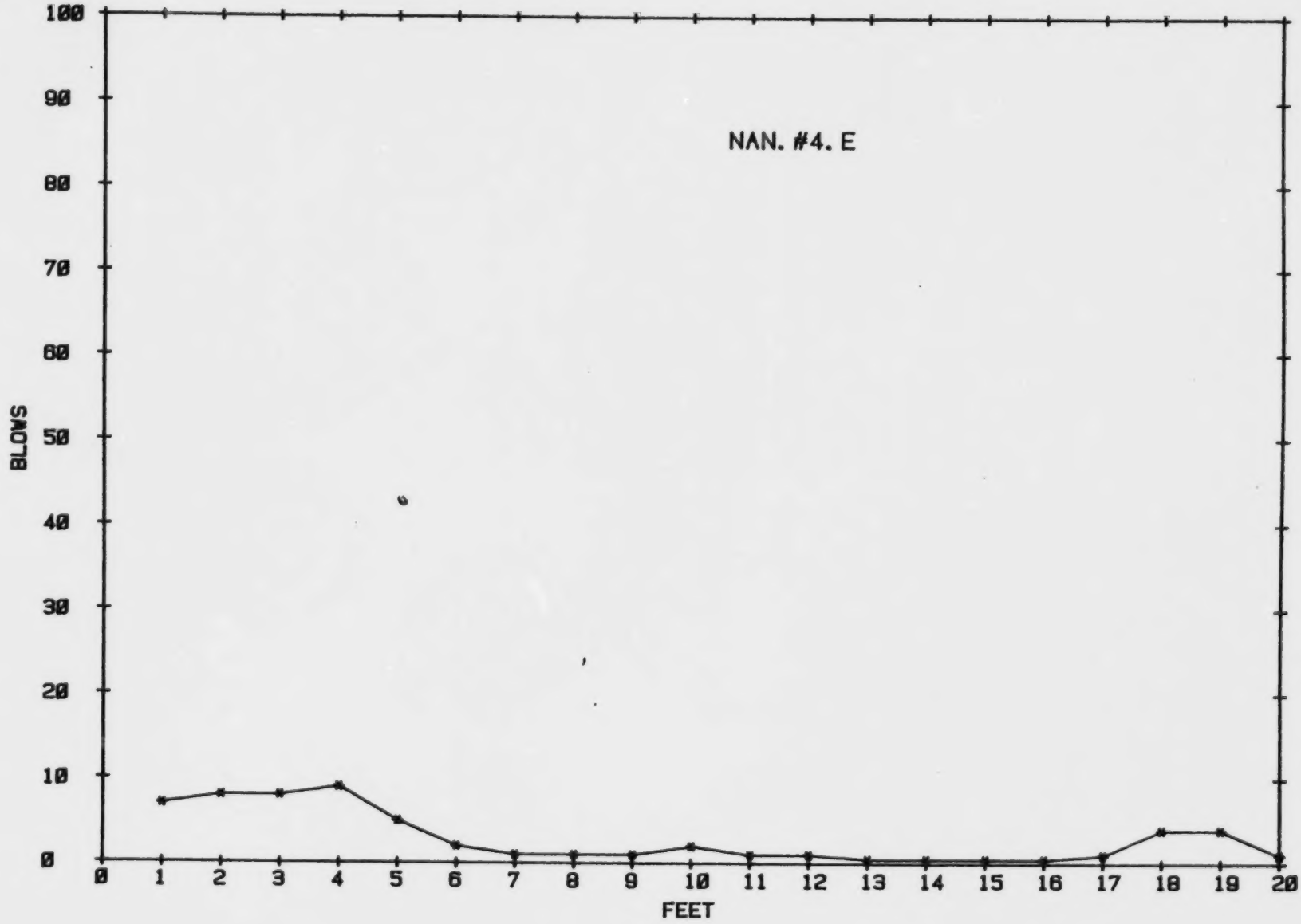
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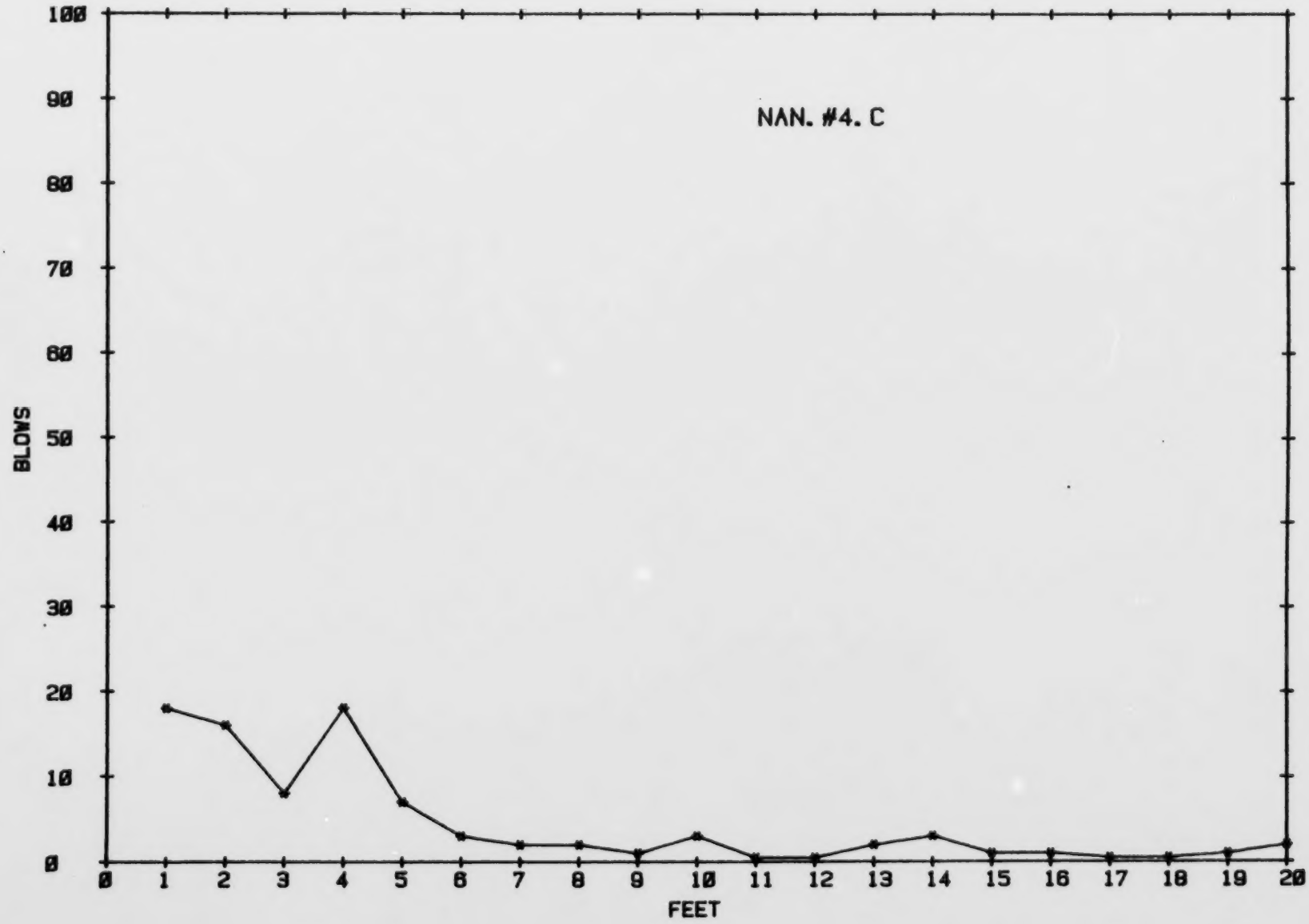
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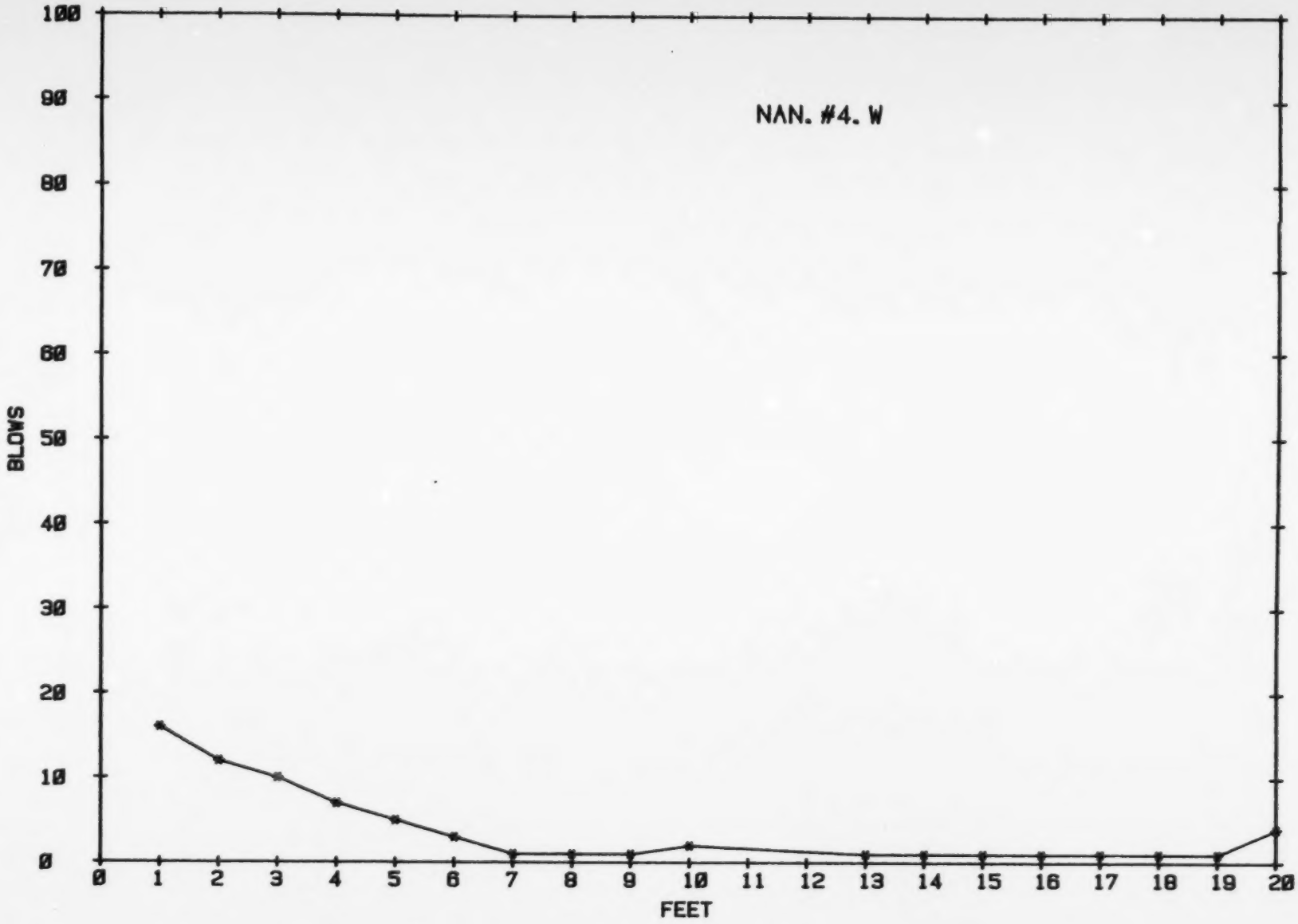
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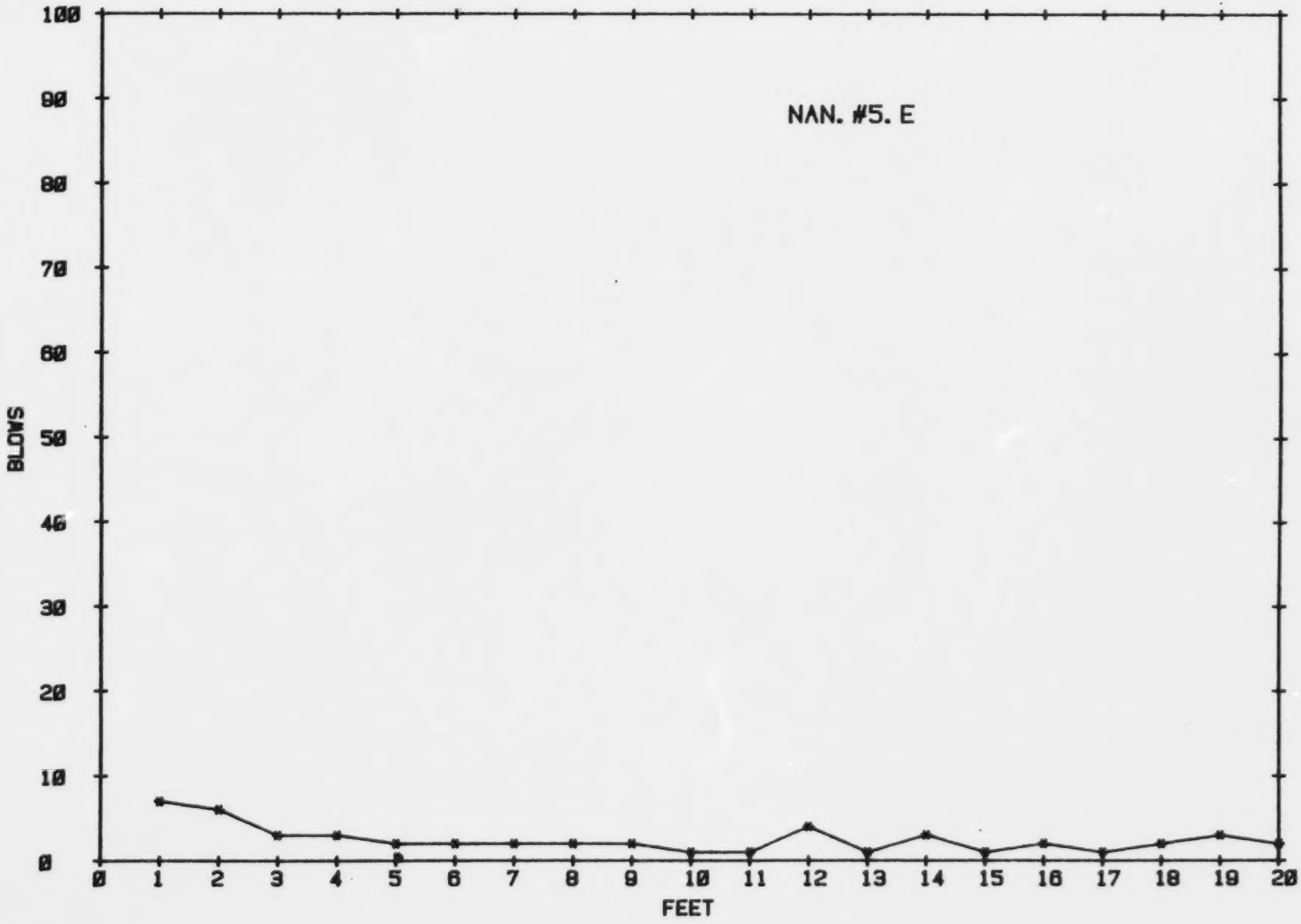
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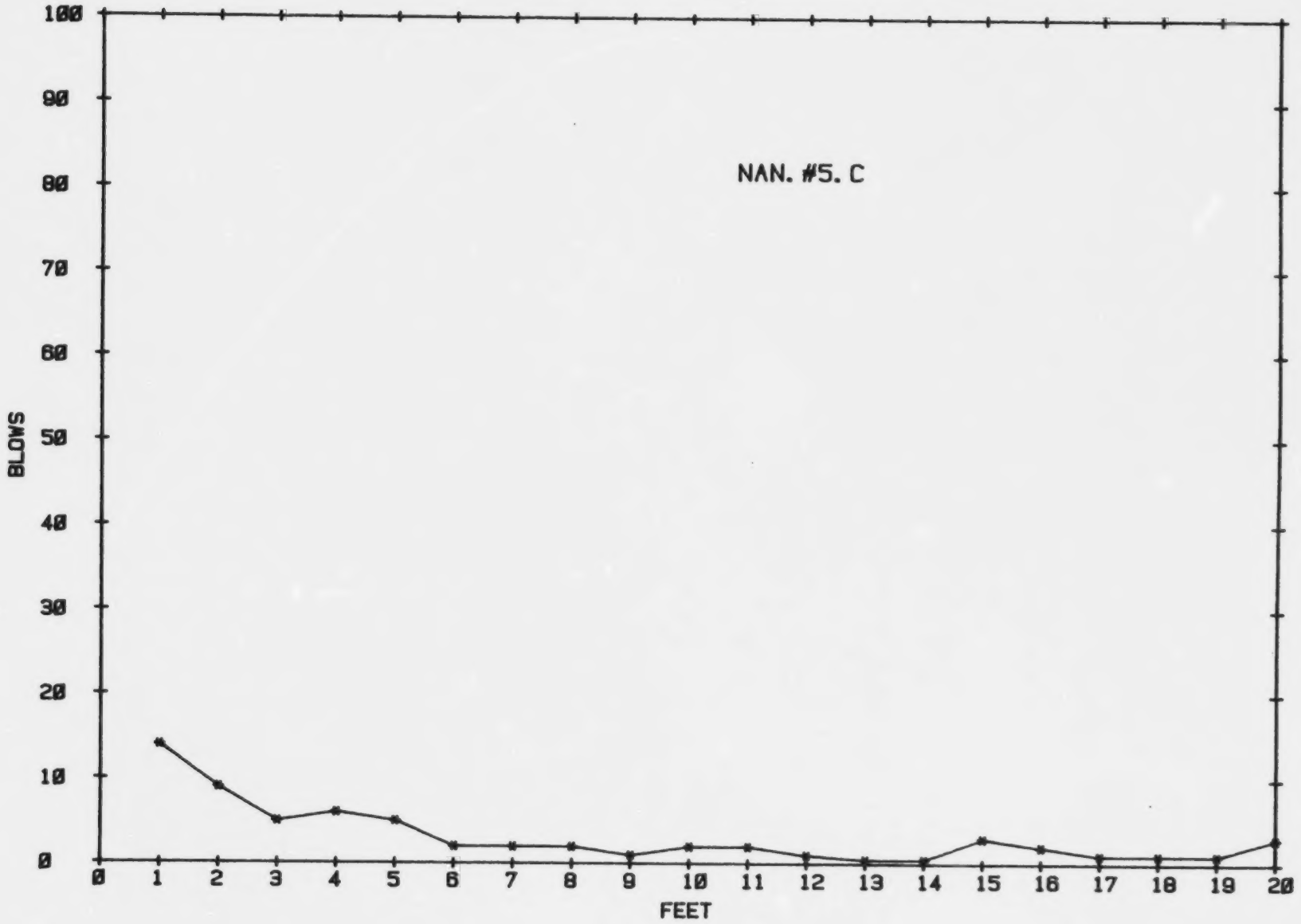
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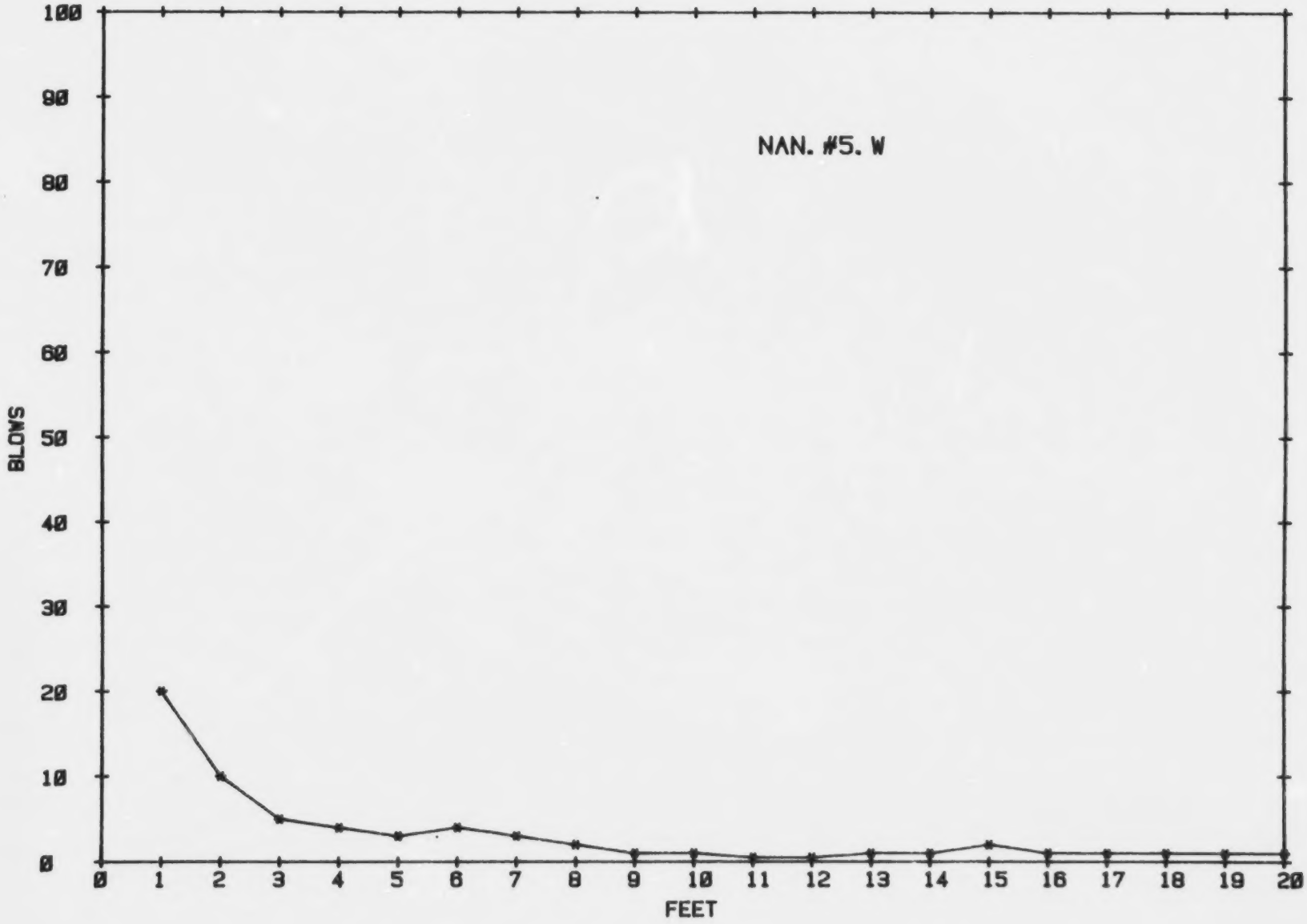
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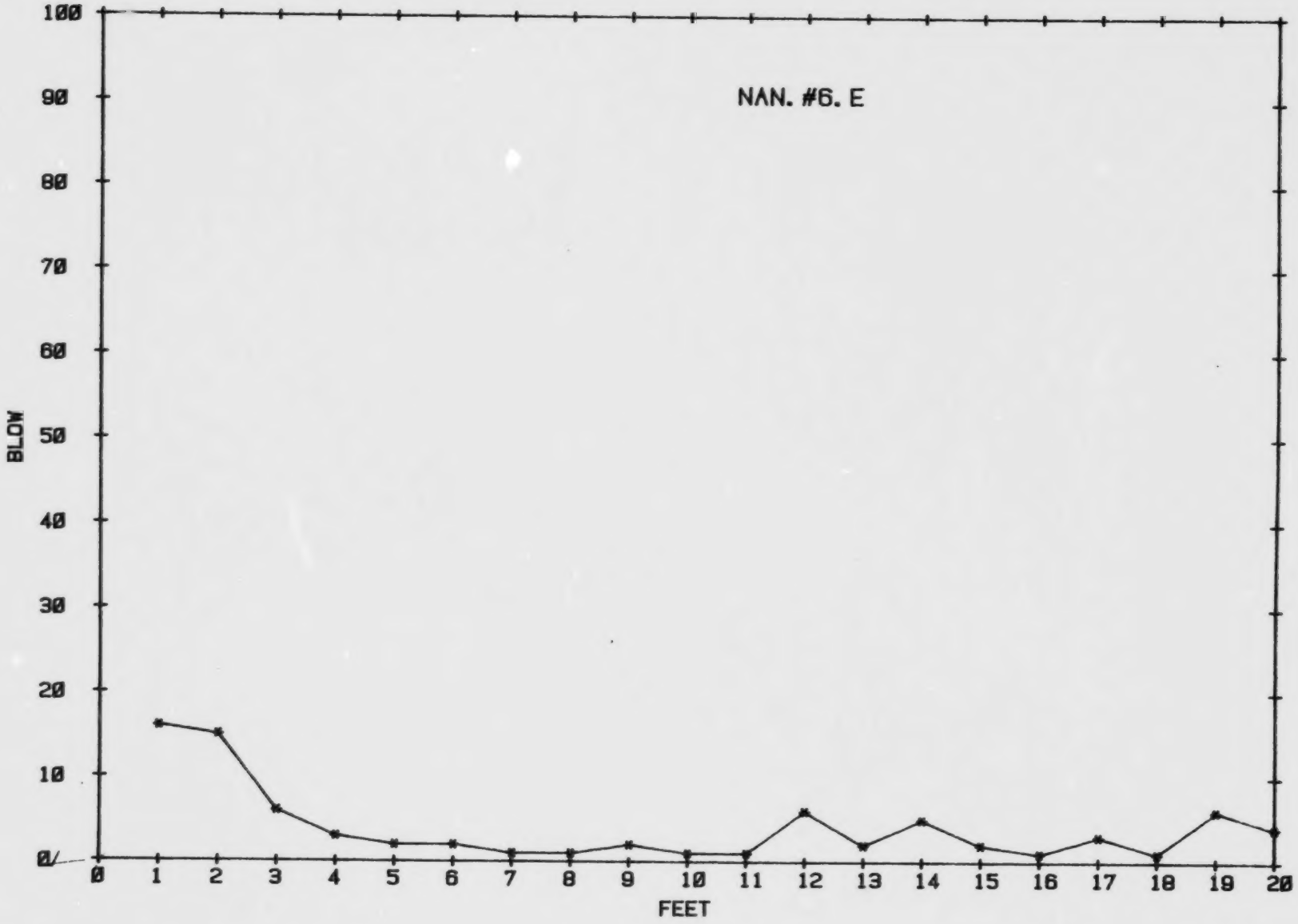
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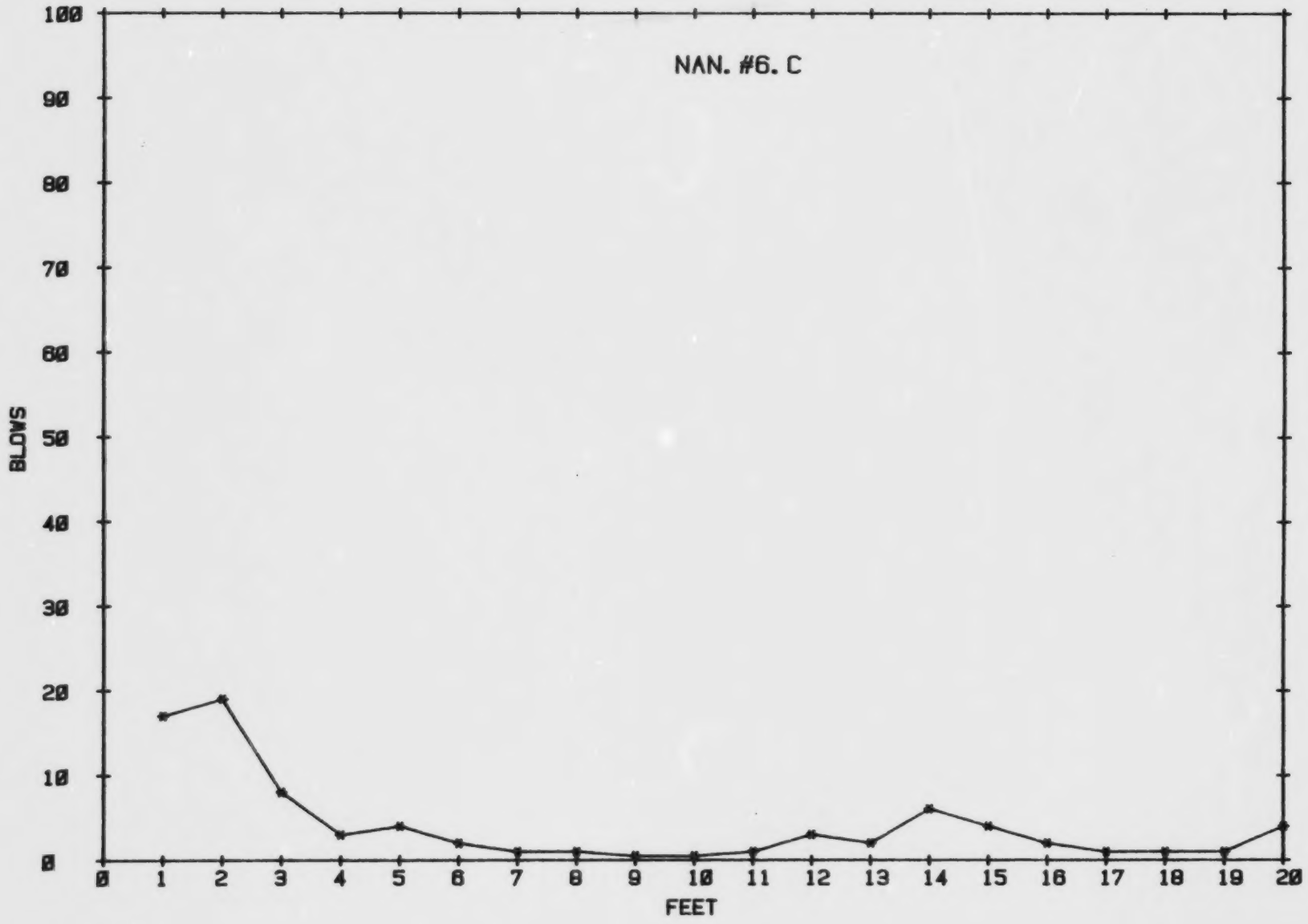
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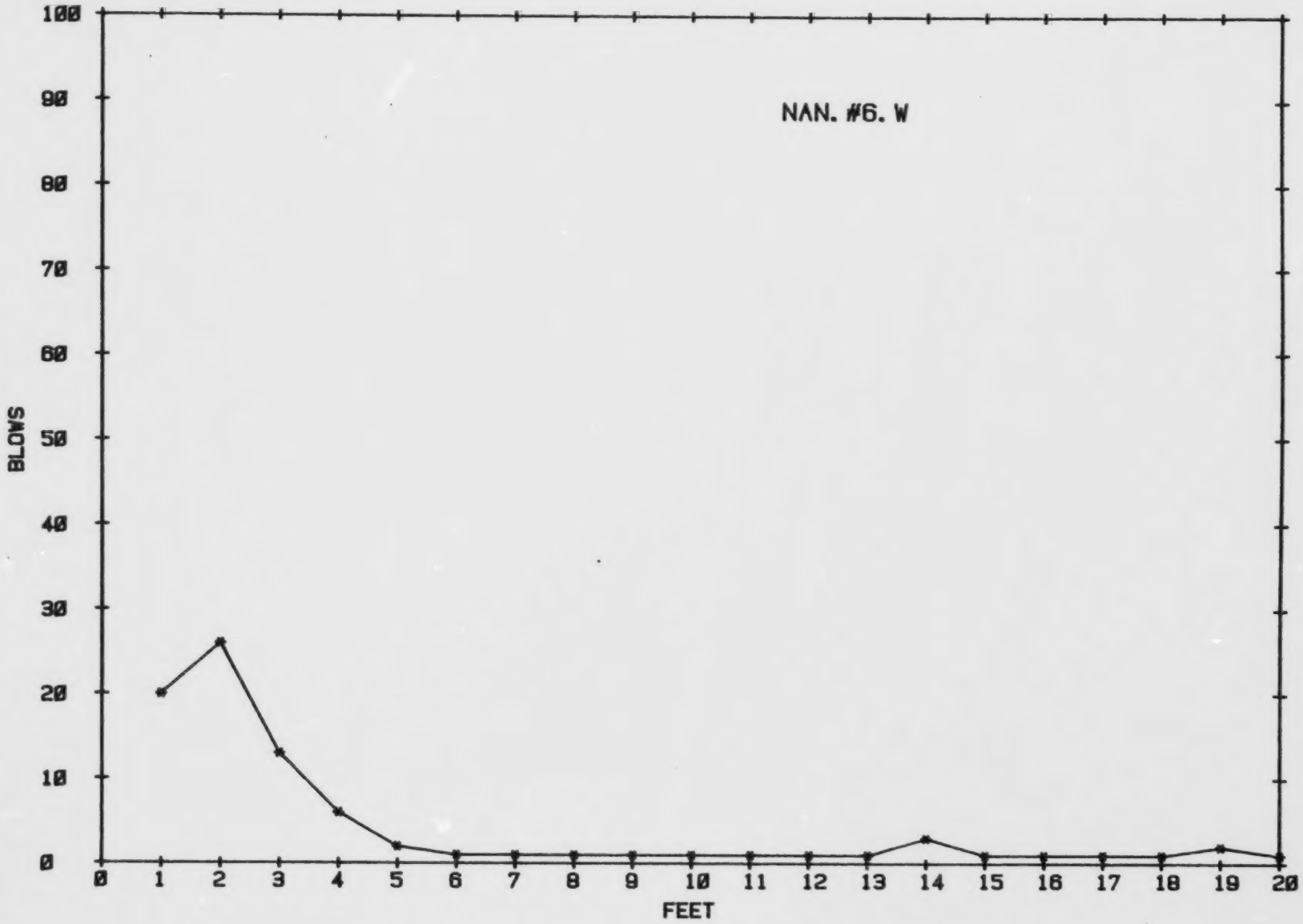
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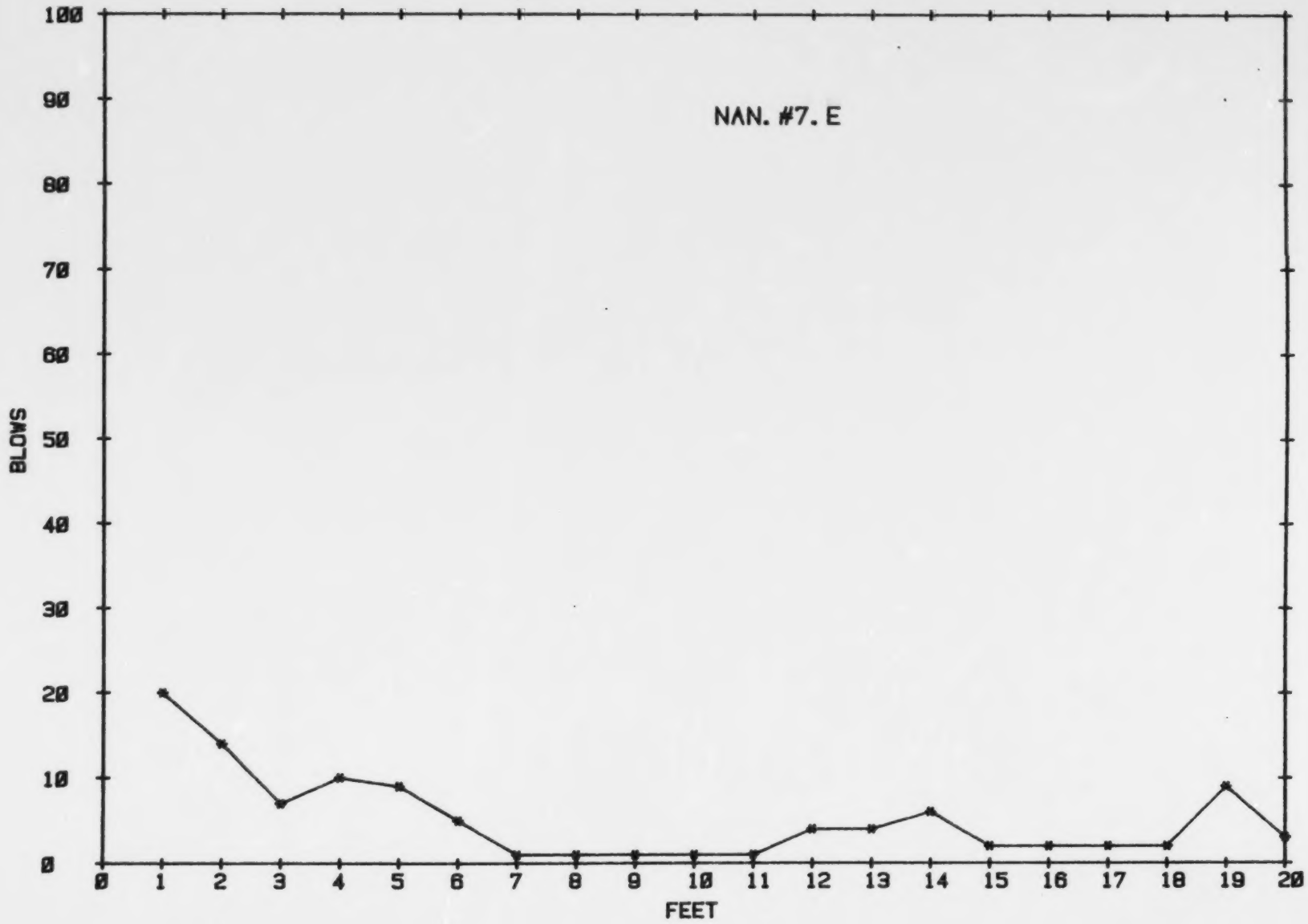
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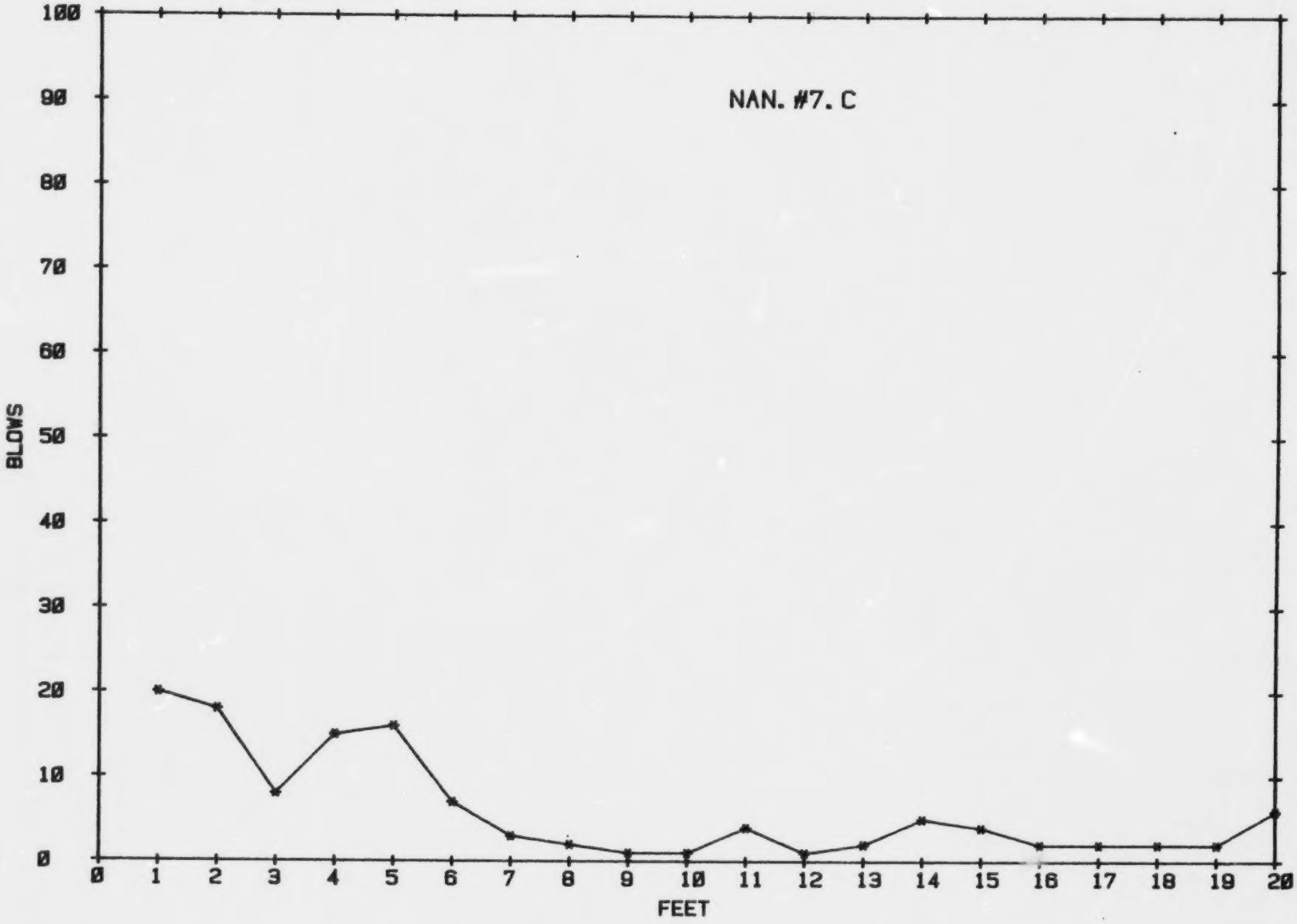
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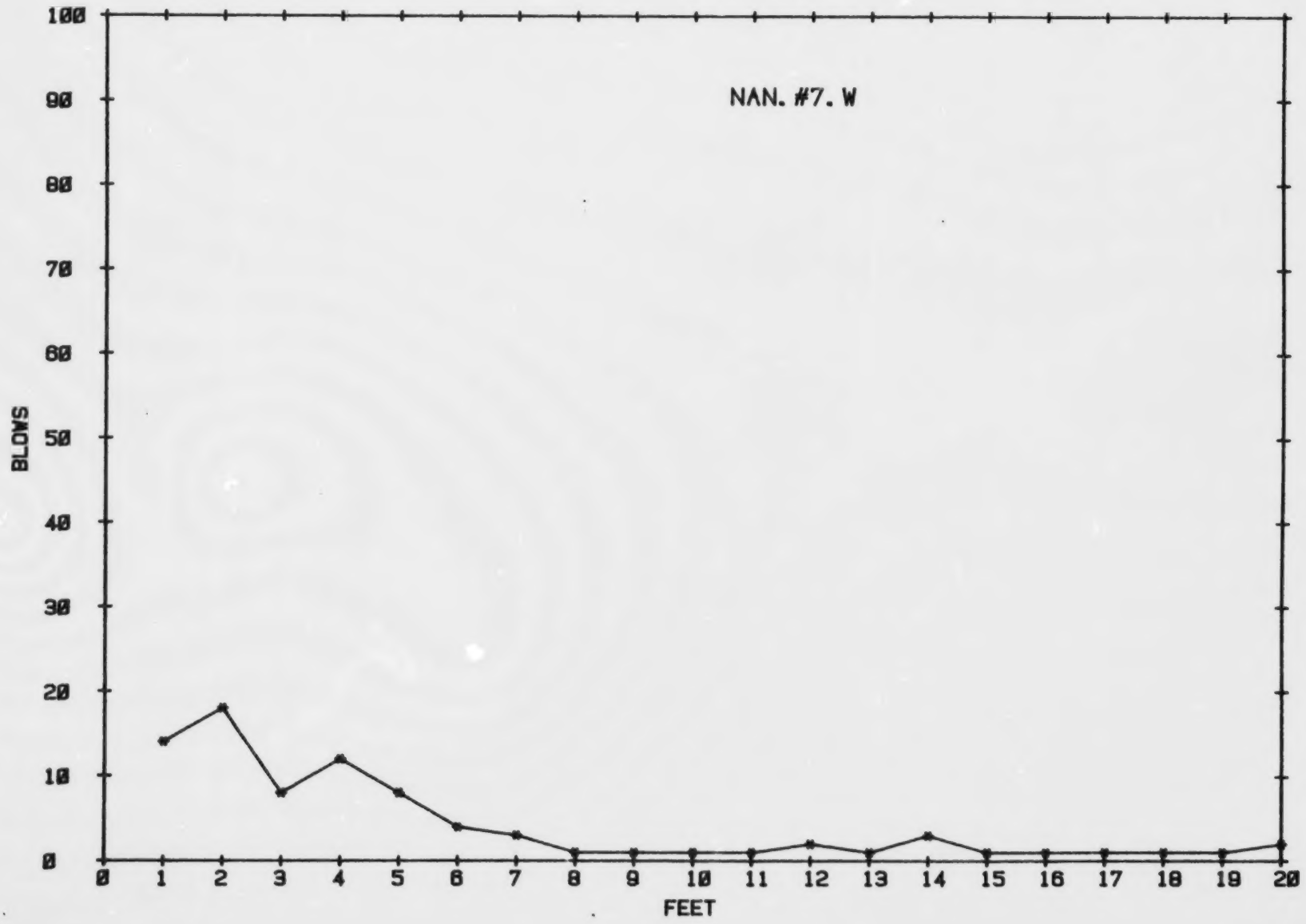
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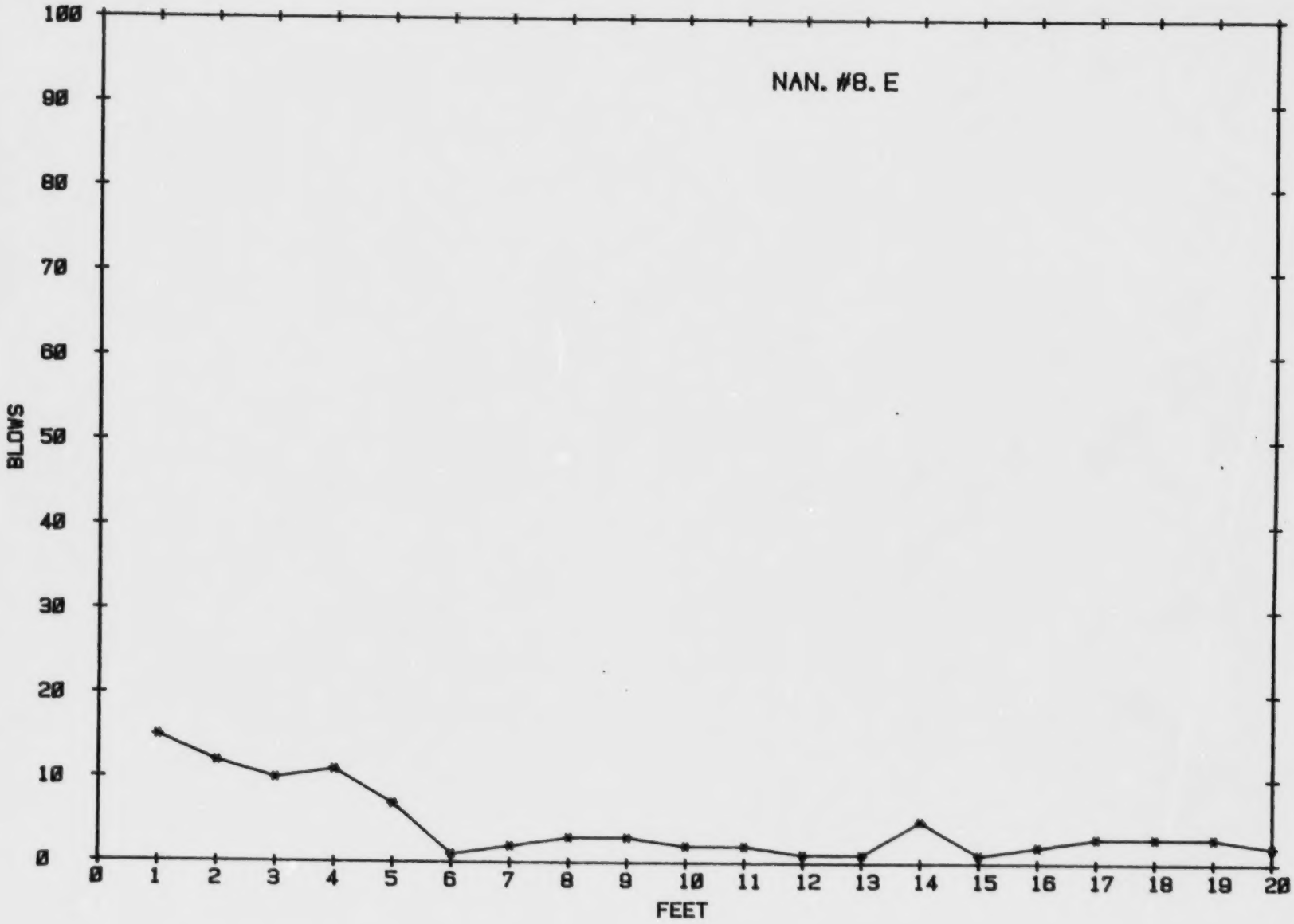
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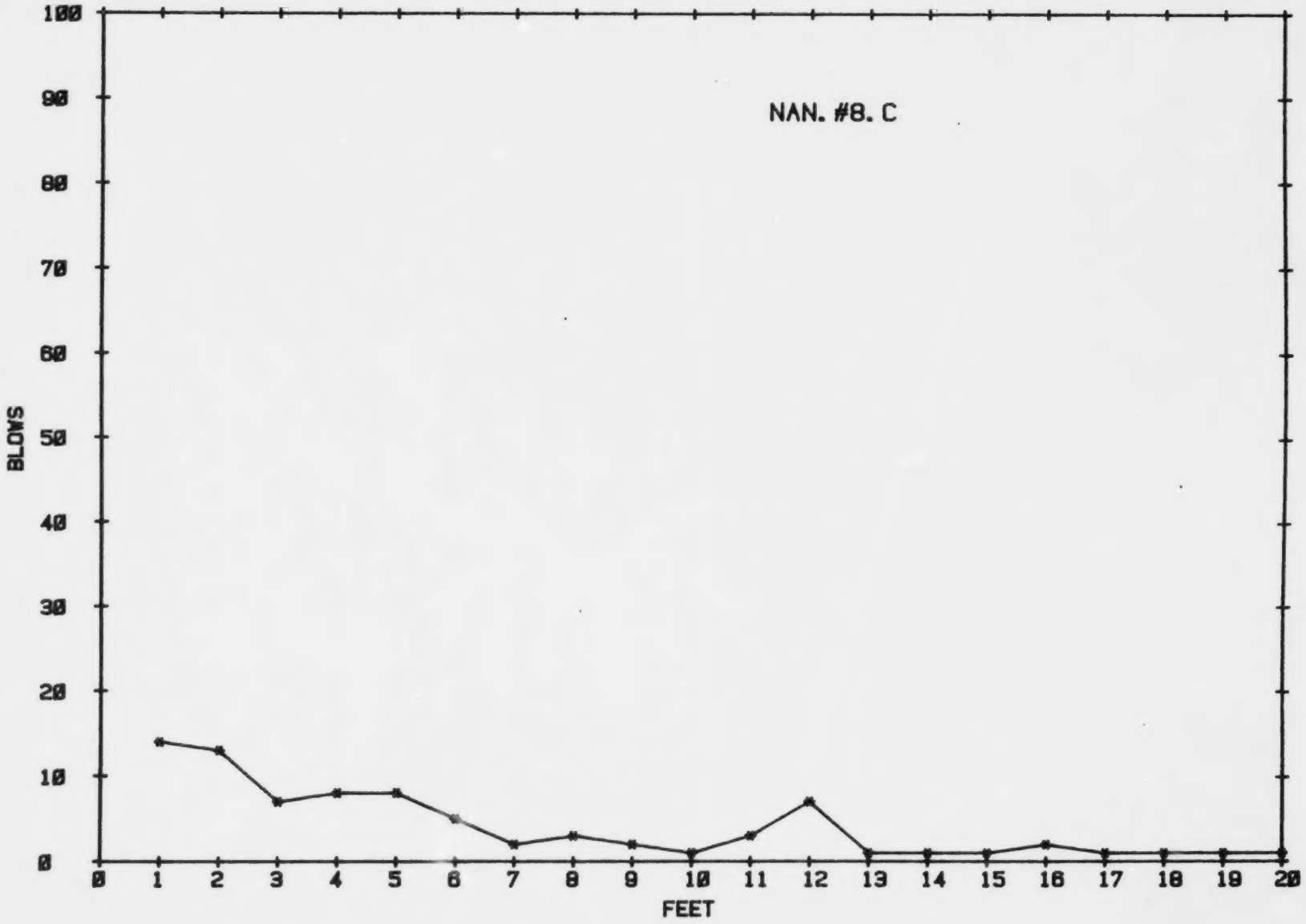
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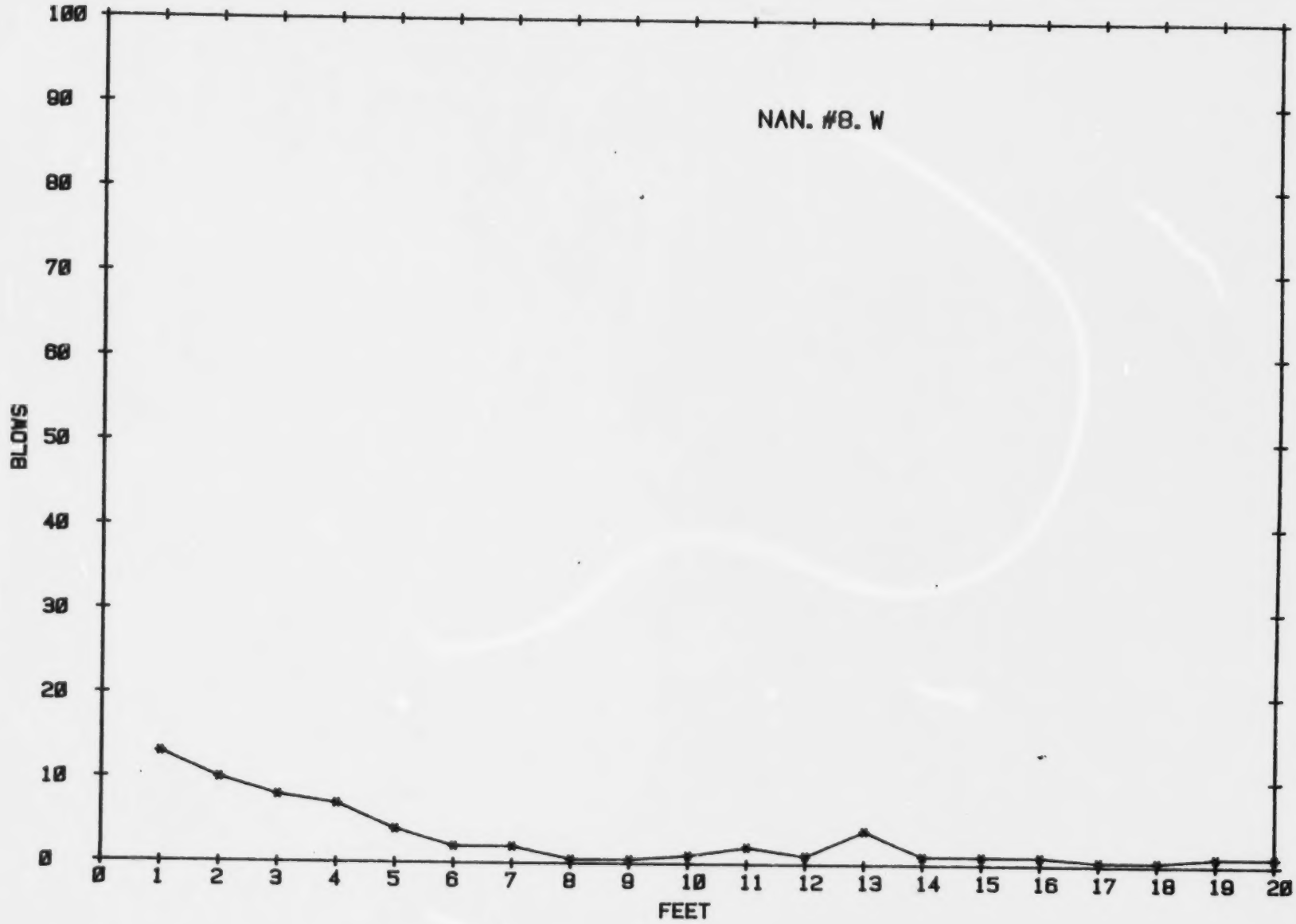
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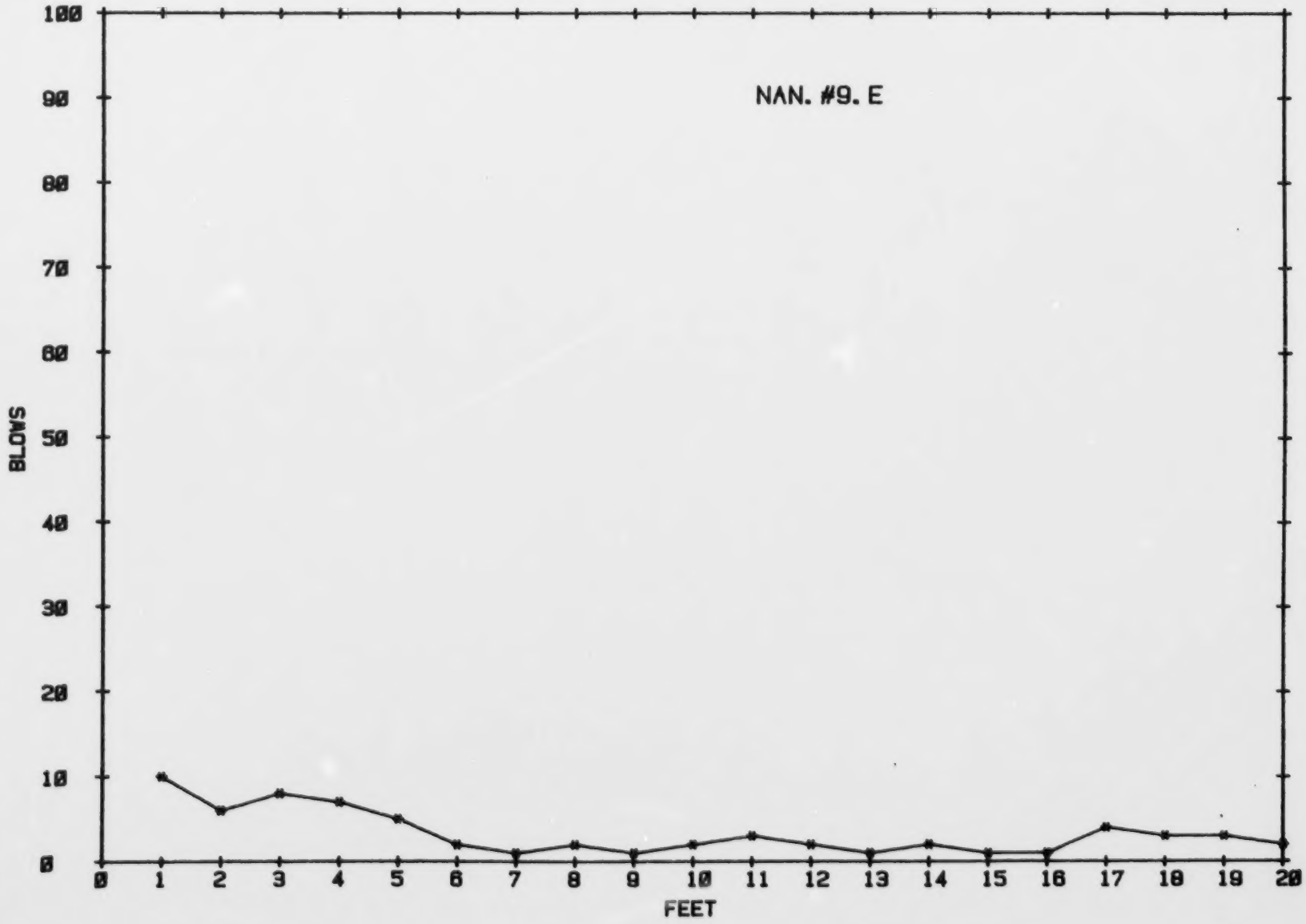
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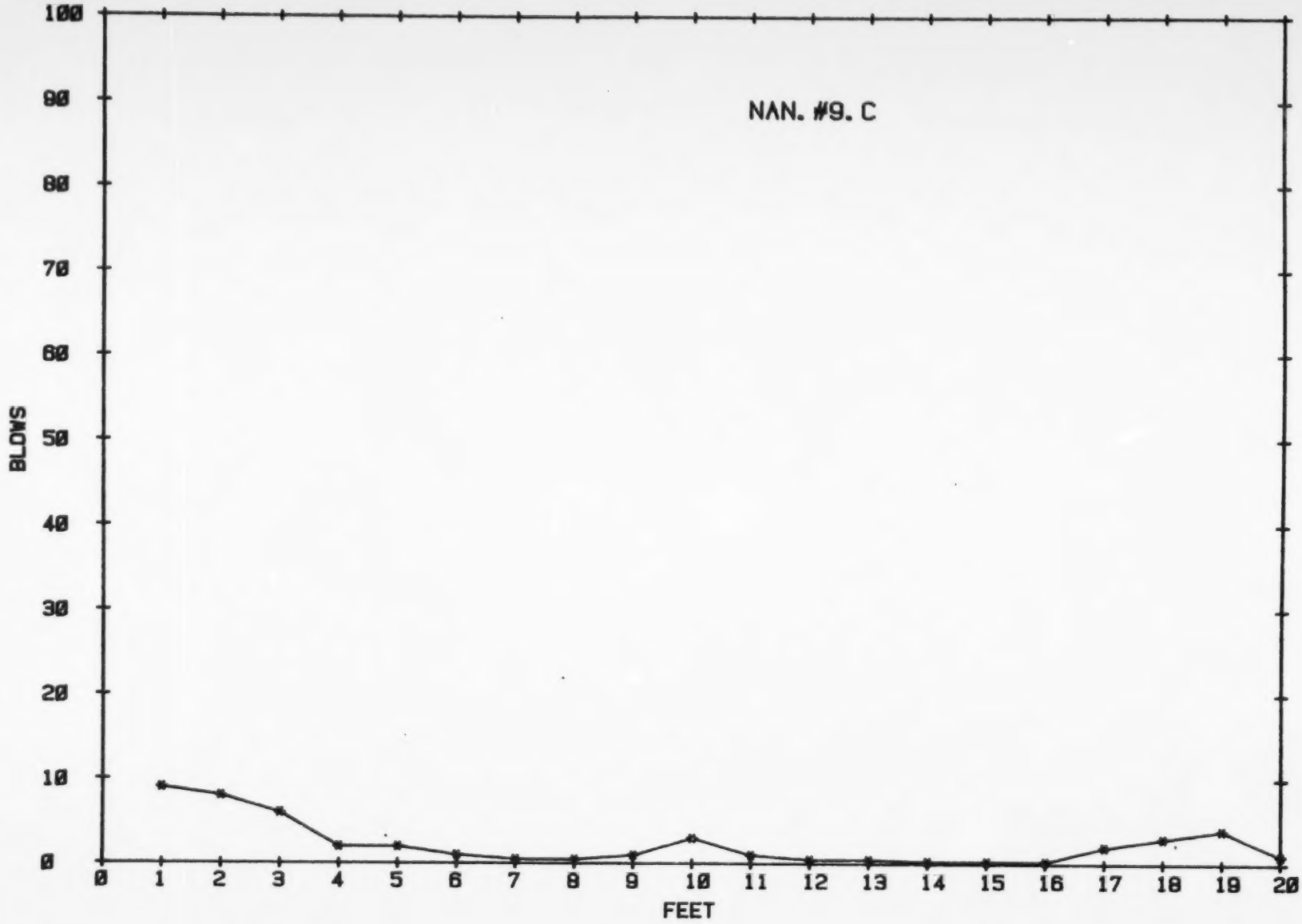
FEET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BLOWS
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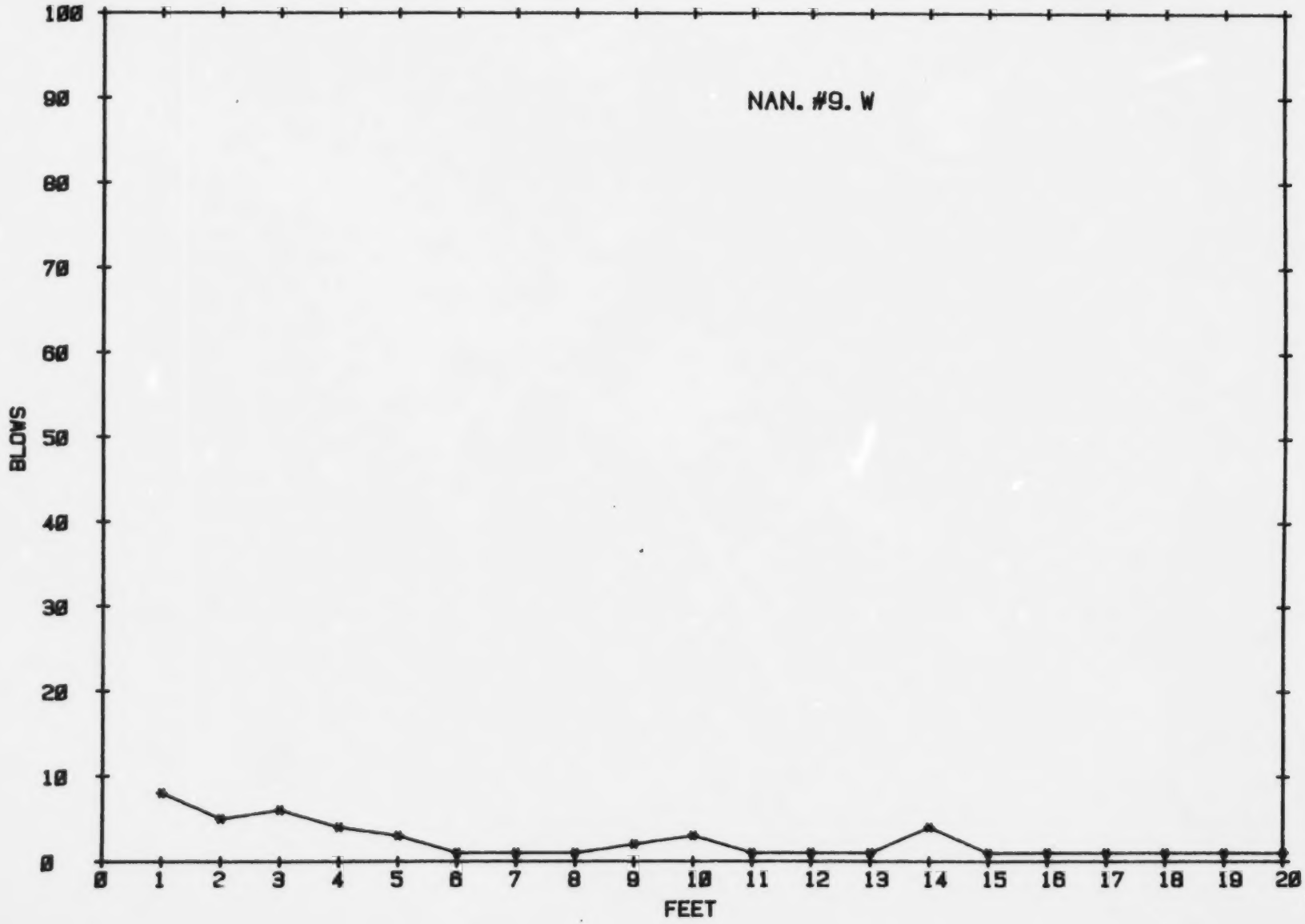
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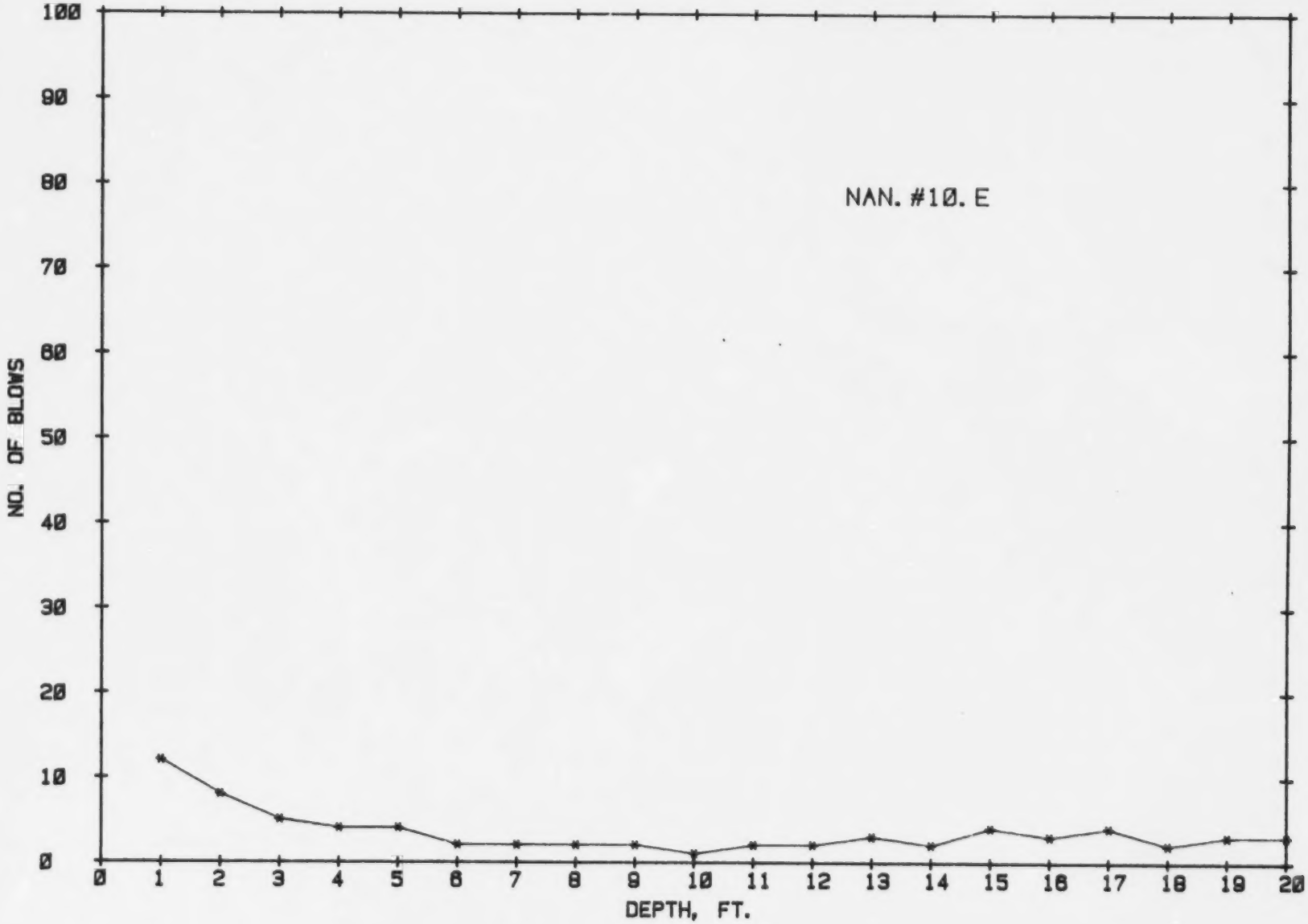
FEET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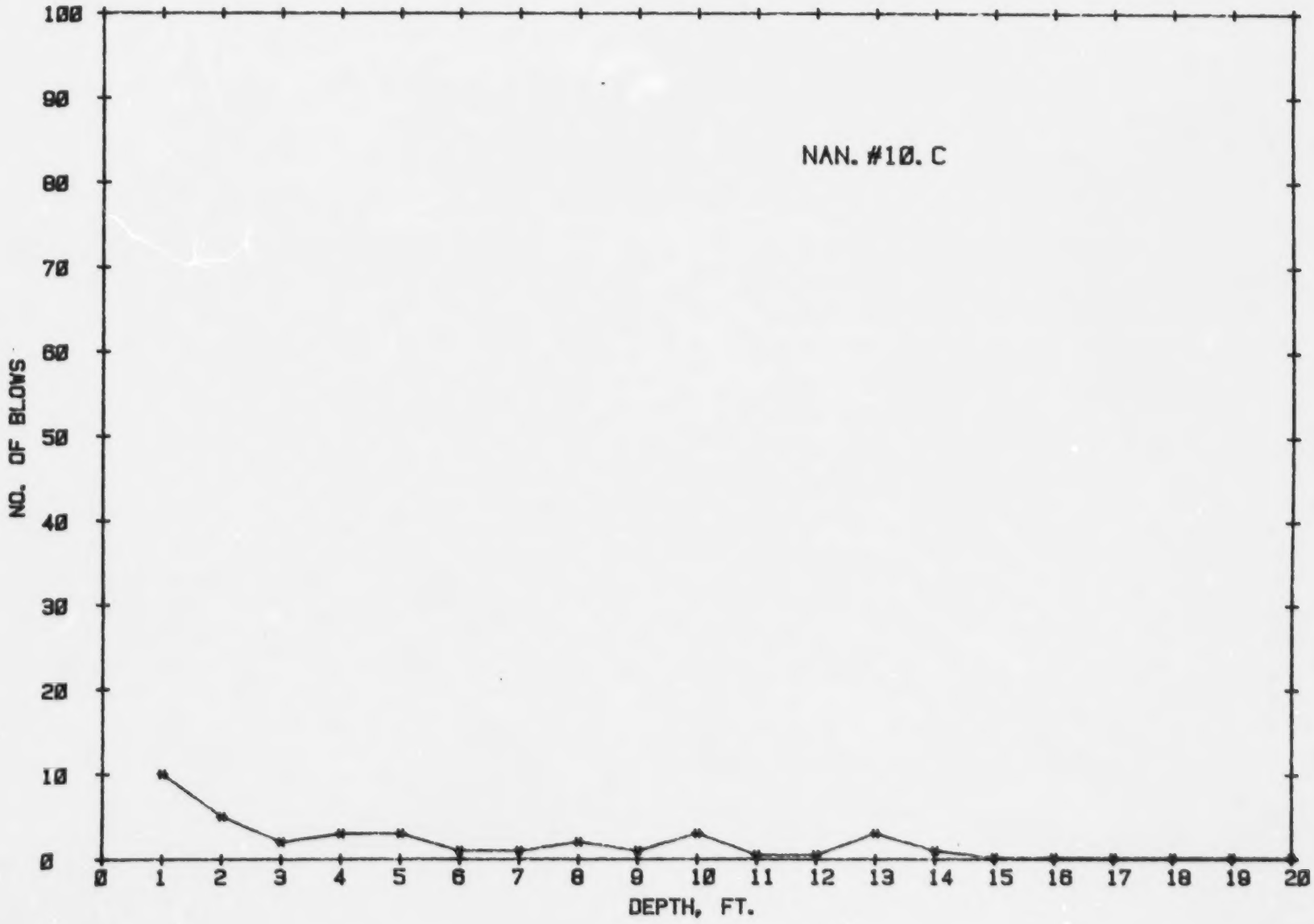
DEPTH, FT.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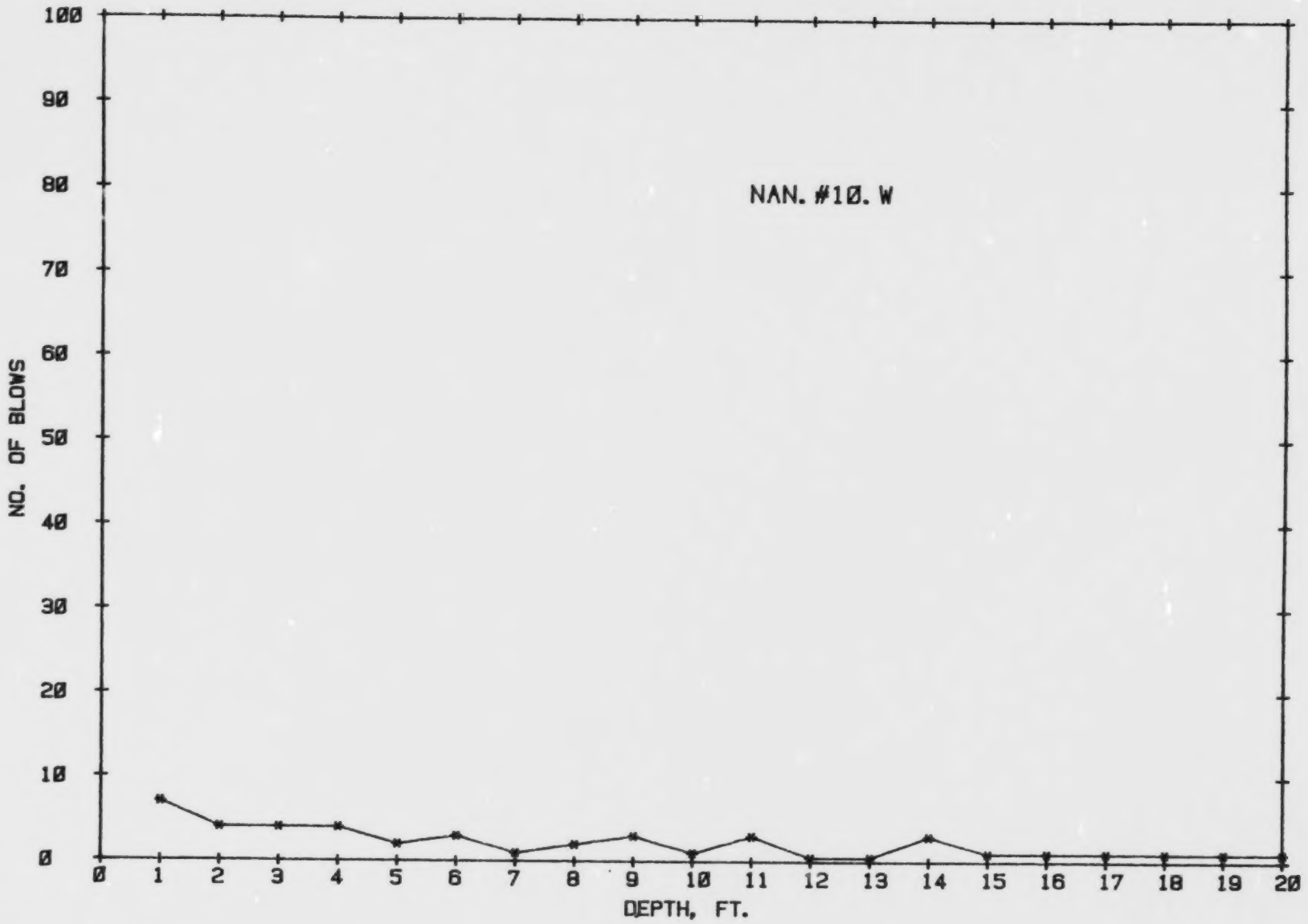
DEPTH, FT.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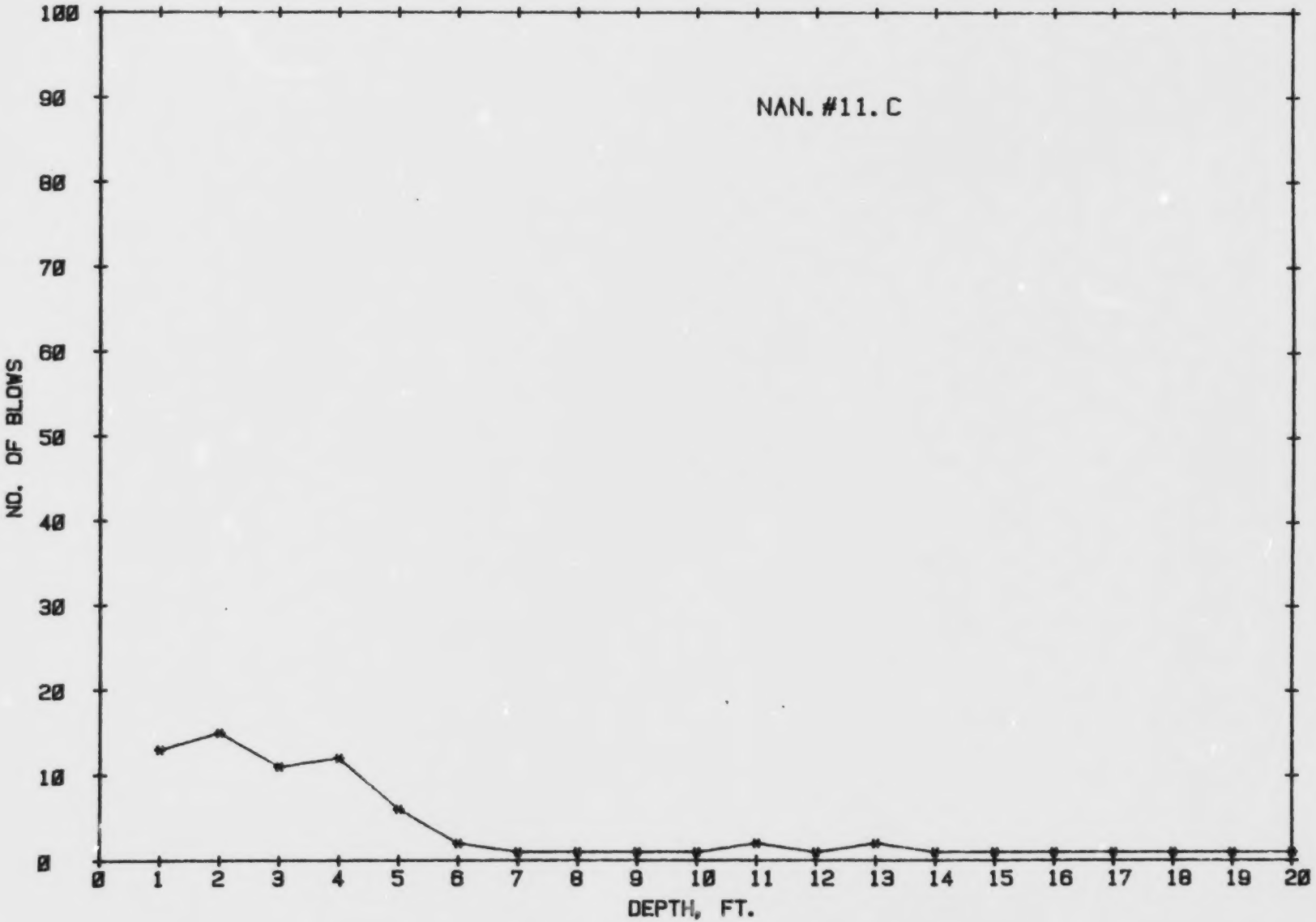
DEPTH, FT.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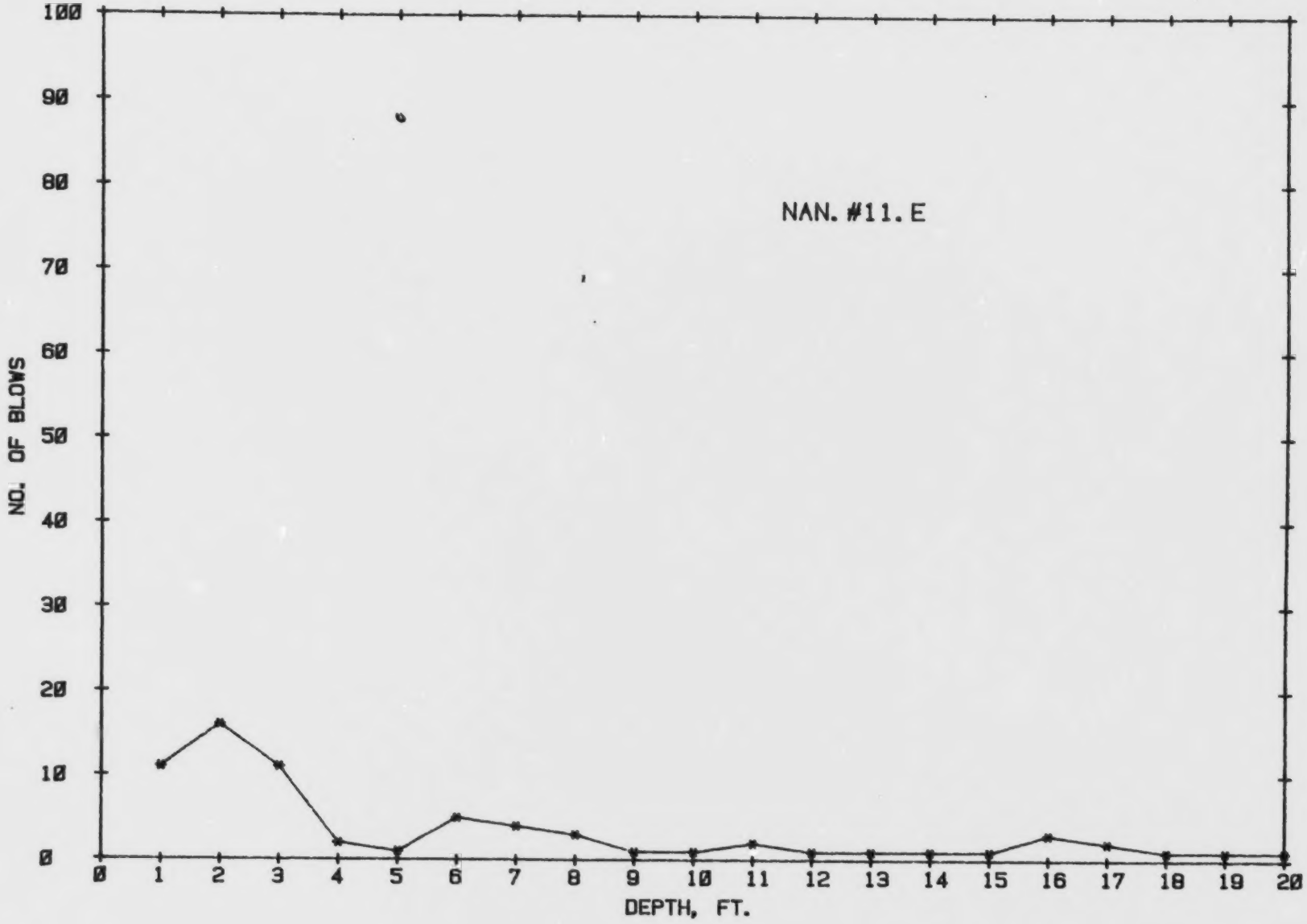
DEPTH, FT.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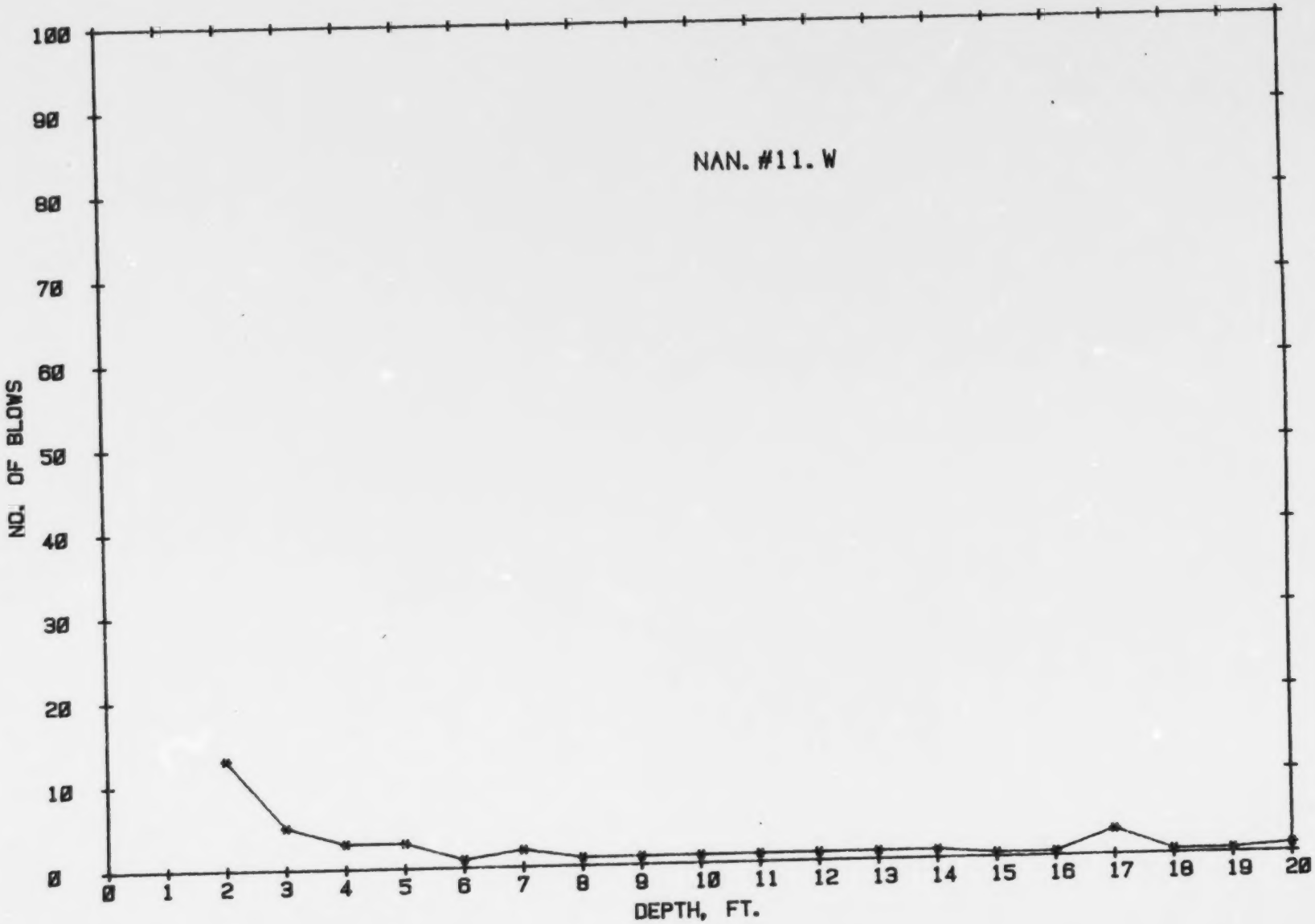
DEPTH, FT.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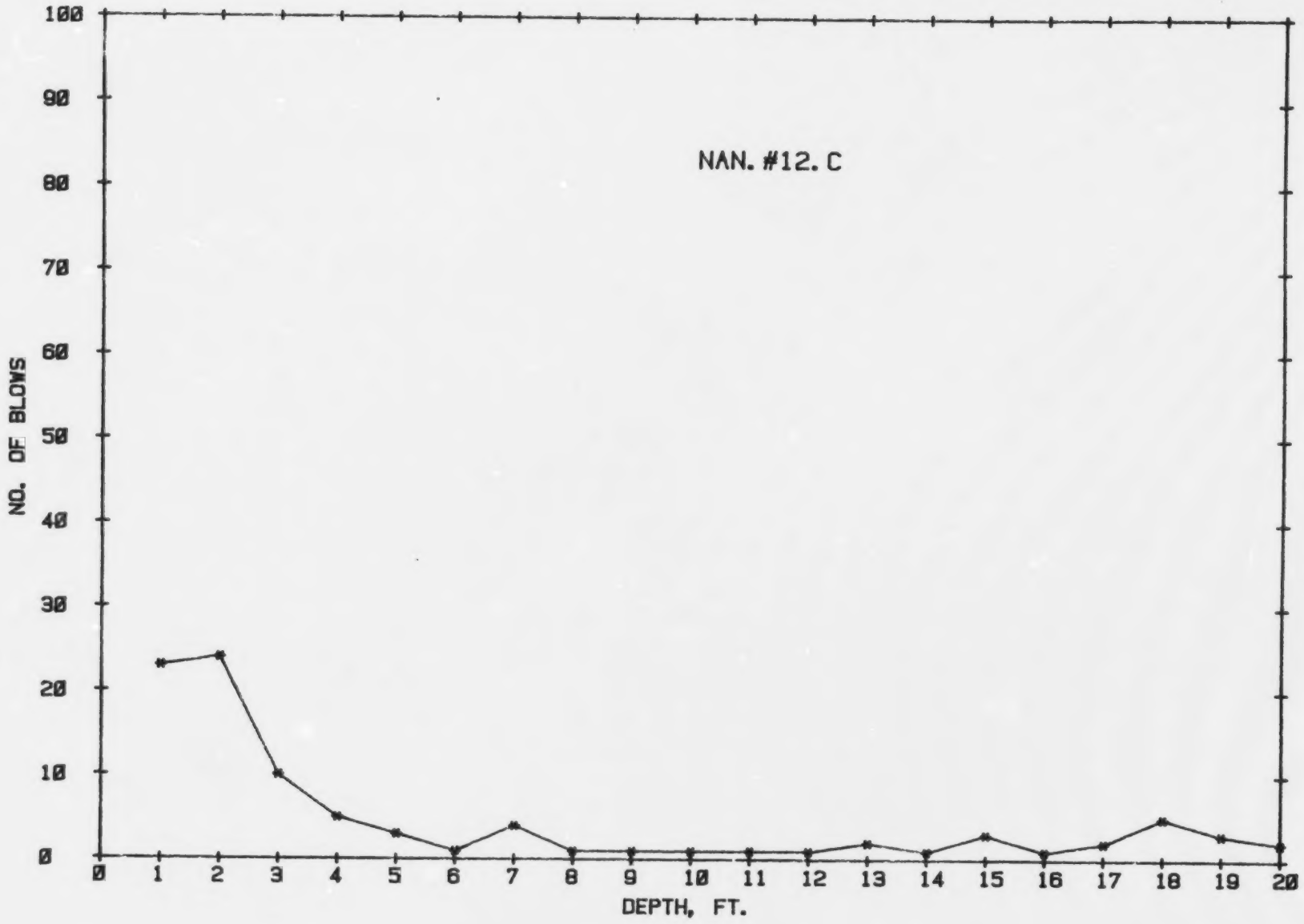
DEPTH, FT.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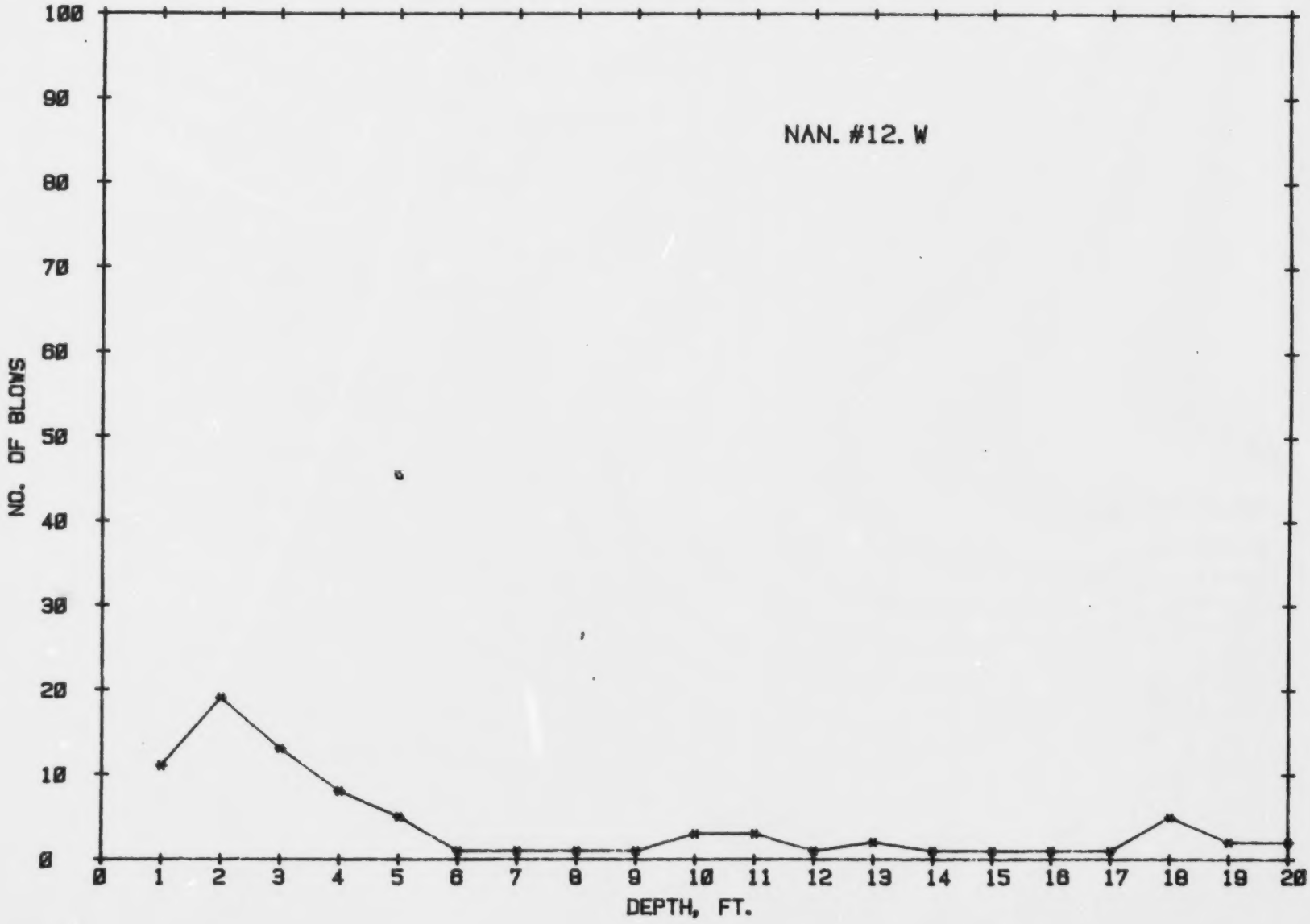
DEPTH, FT.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DEPTH, FT.
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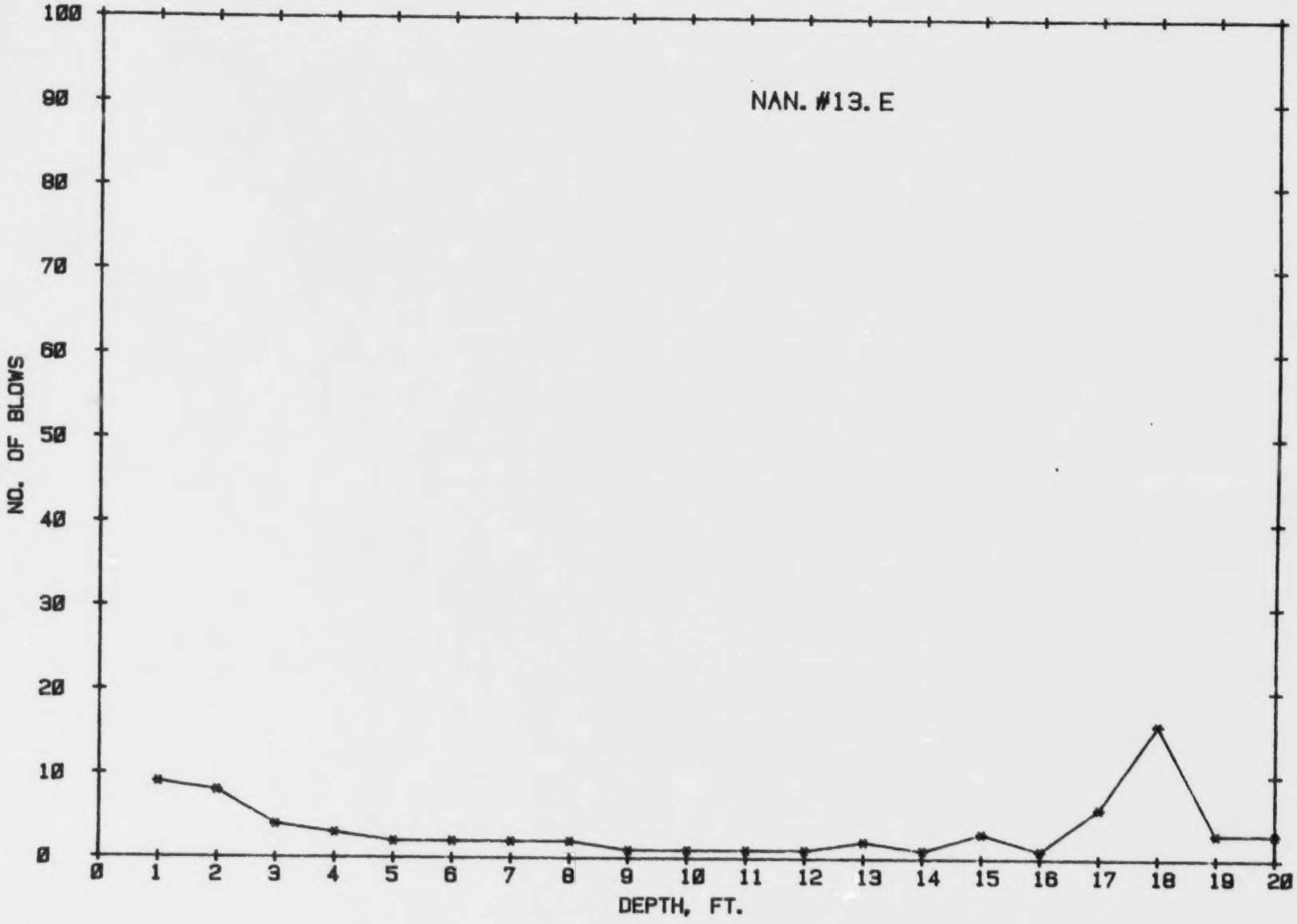
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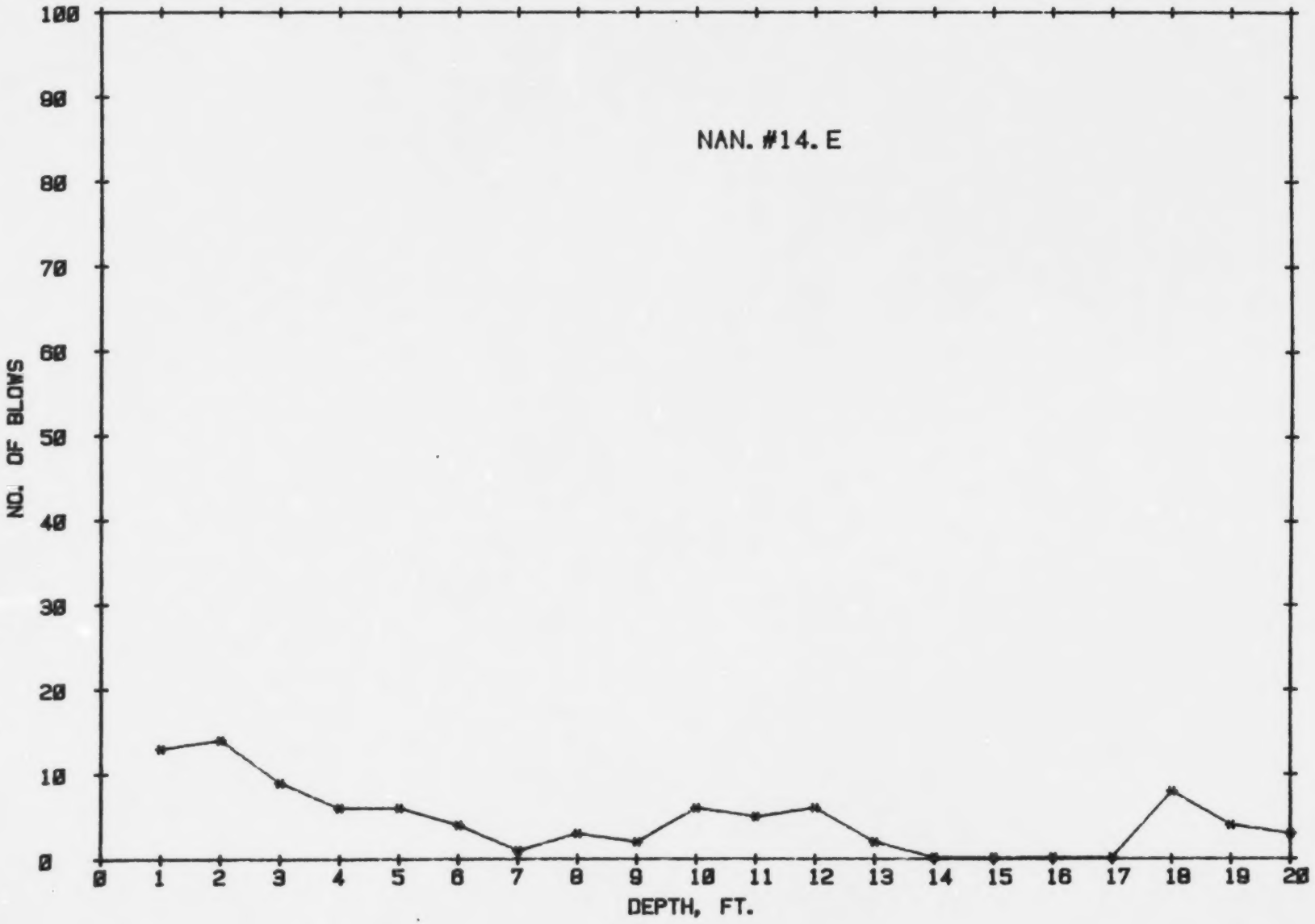
DEPTH, FT.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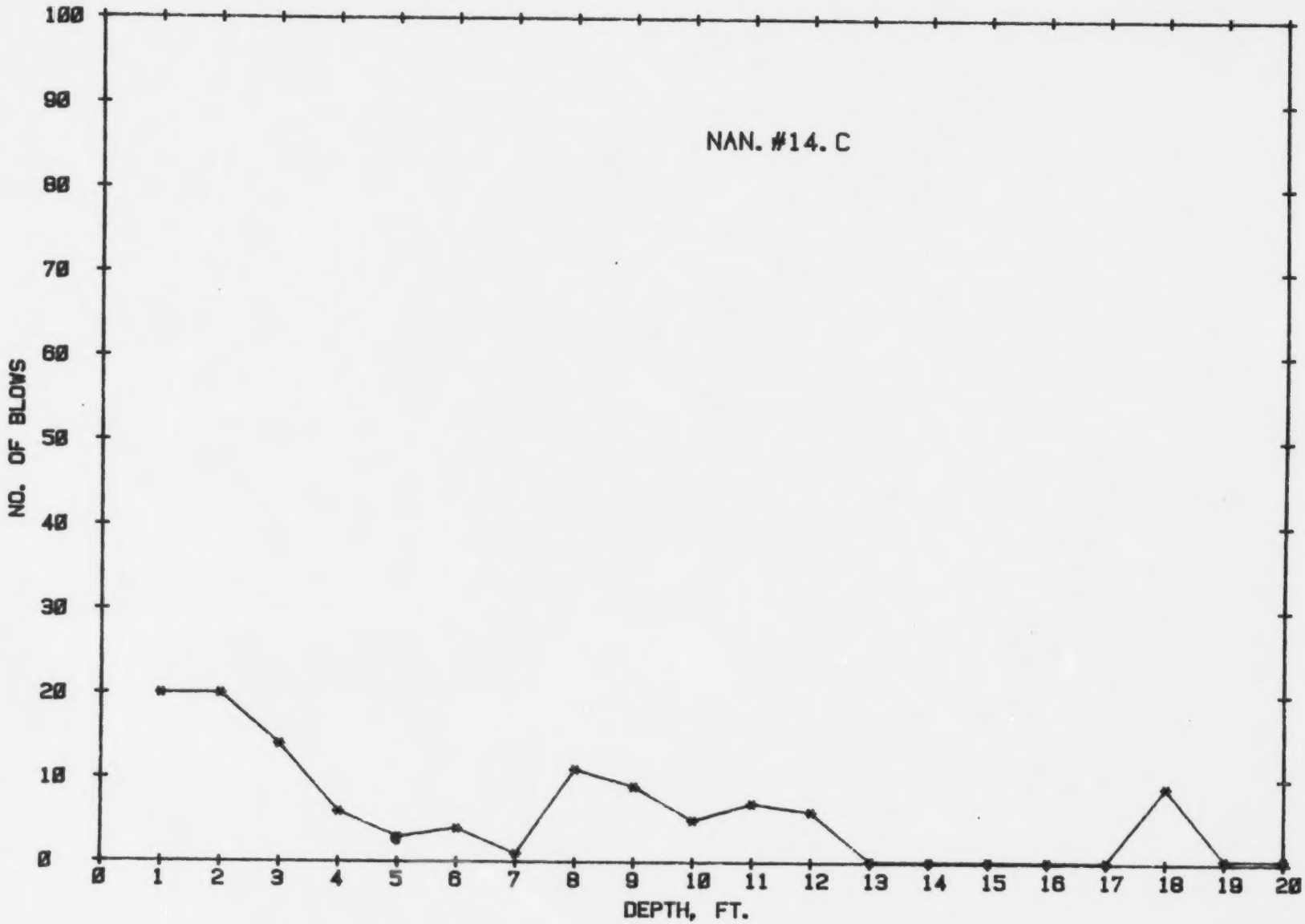
DEPTH, FT.


NAN. #14. C
NO. OF BLOWS
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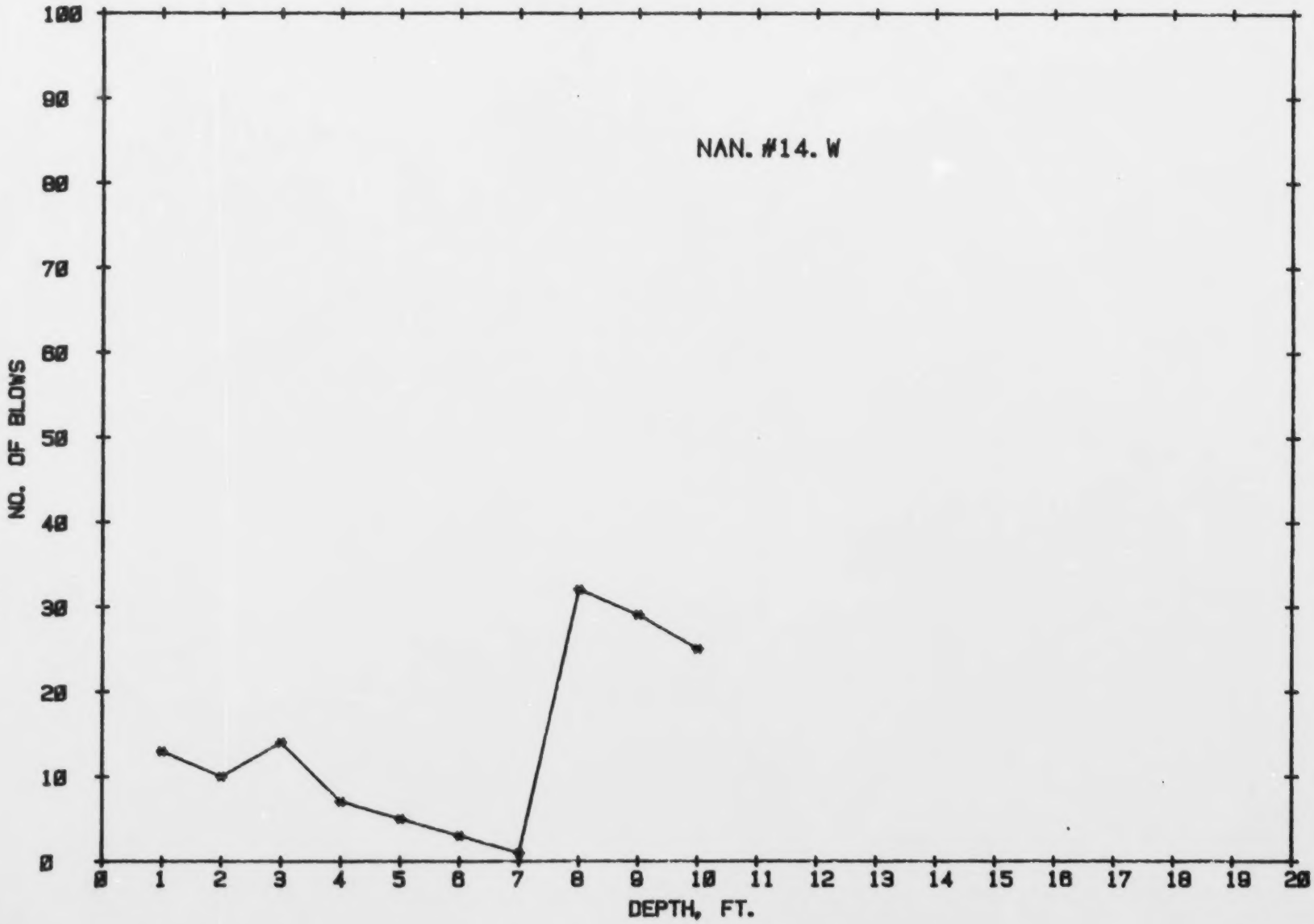
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.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NO. OF BLOWS
DEPTH, FT.
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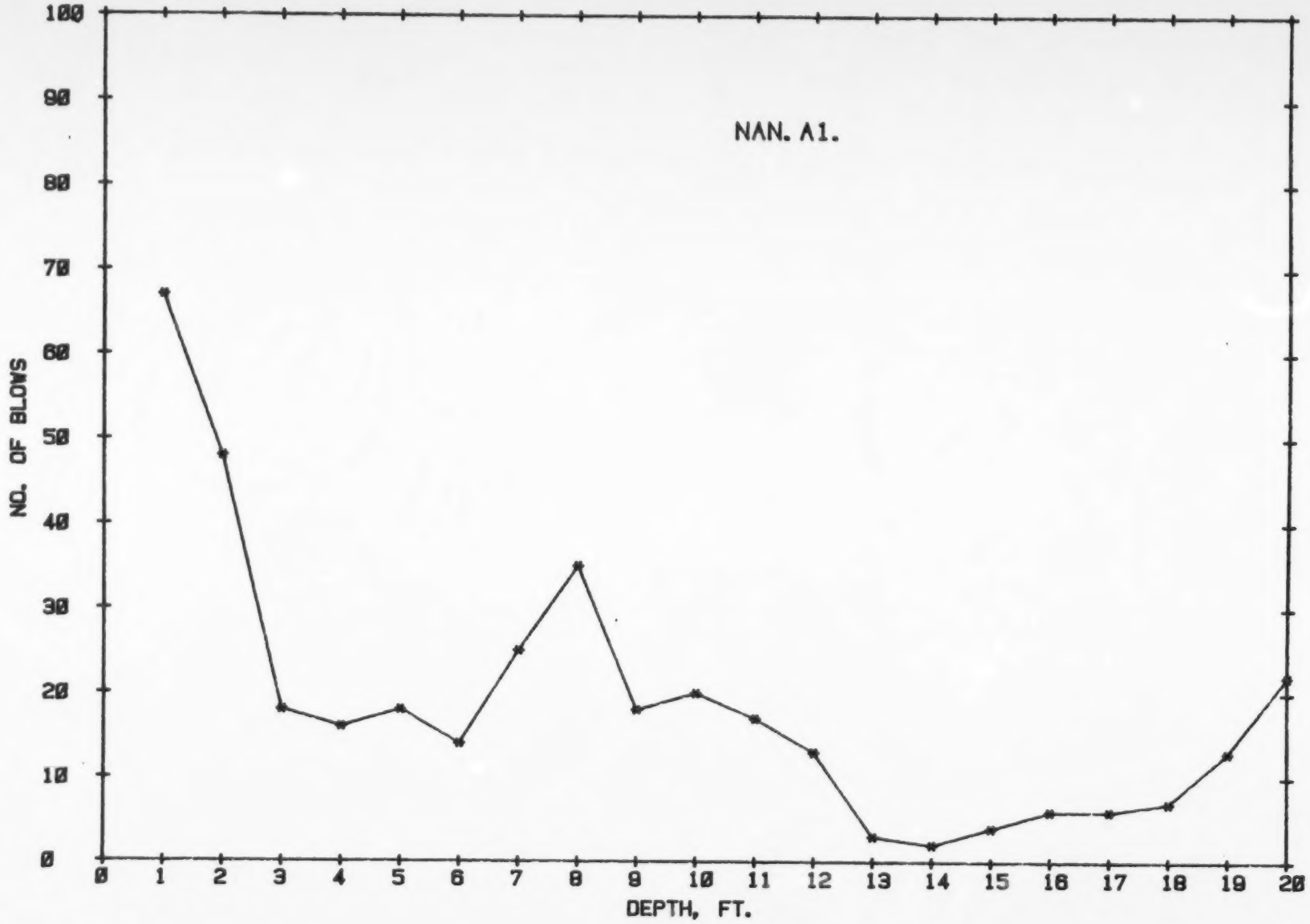
100
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20


NAN. A1.
NO. OF BLOWS
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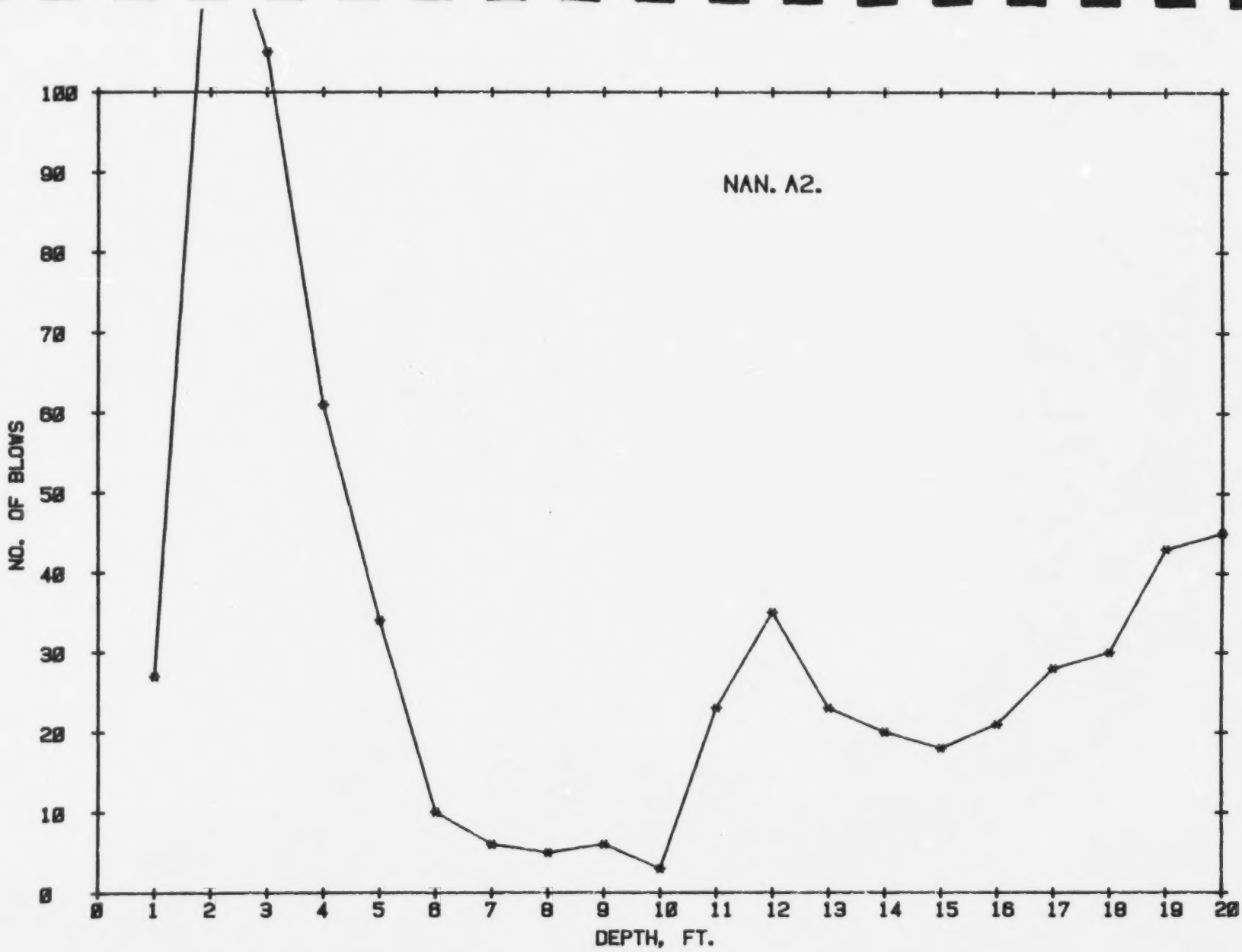
DEPTH, FT.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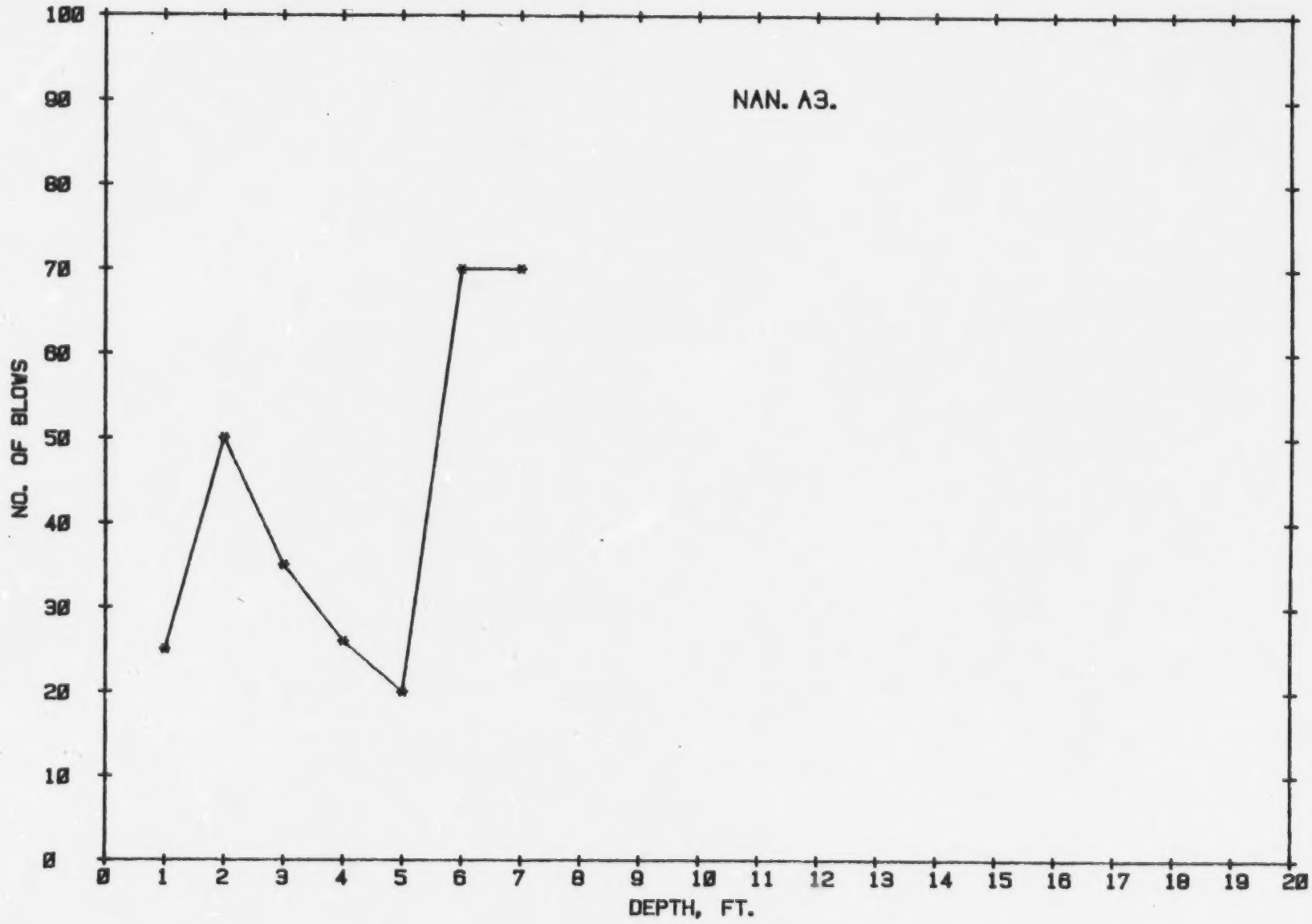
DEPTH, FT.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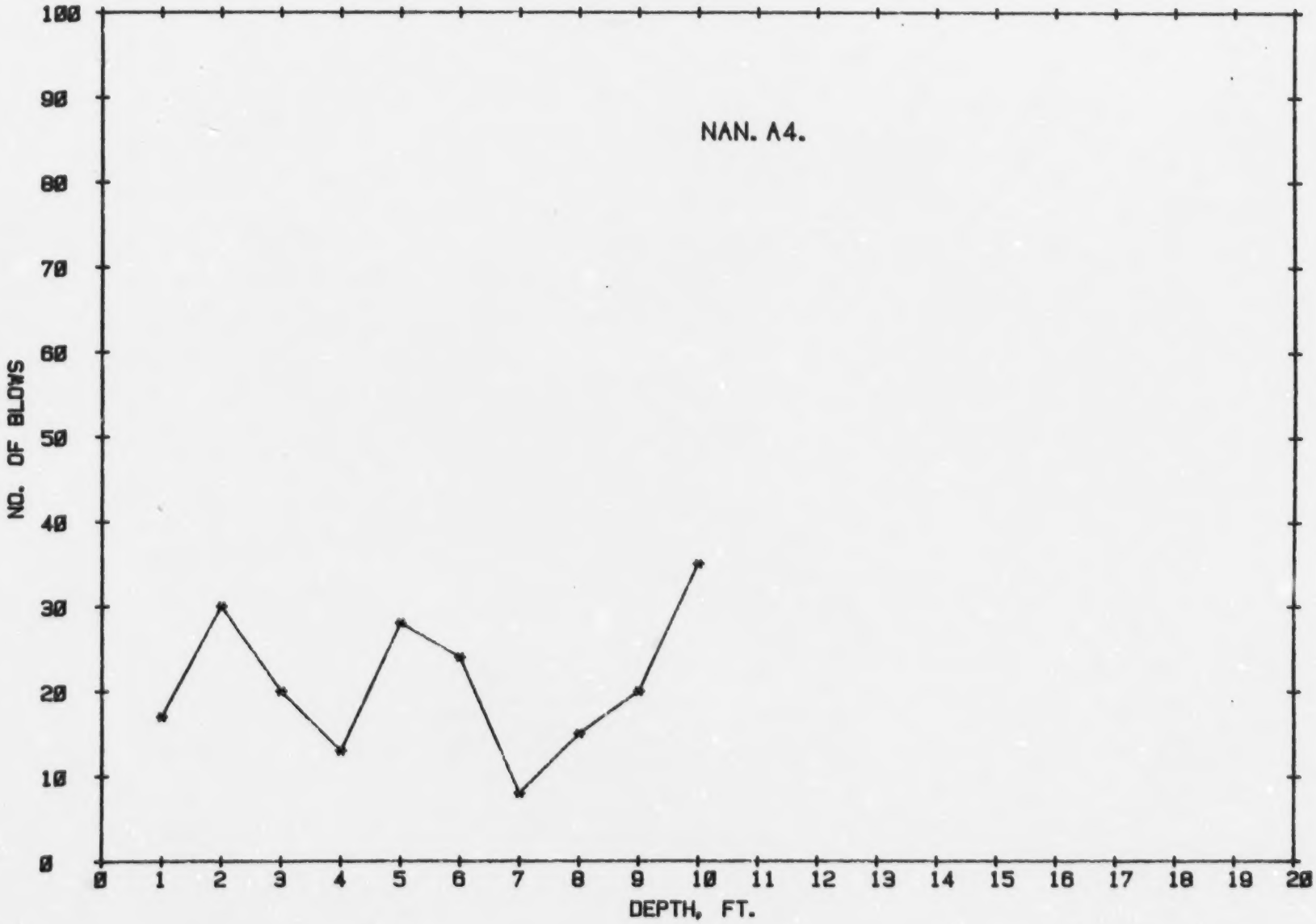
DEPTH, FT.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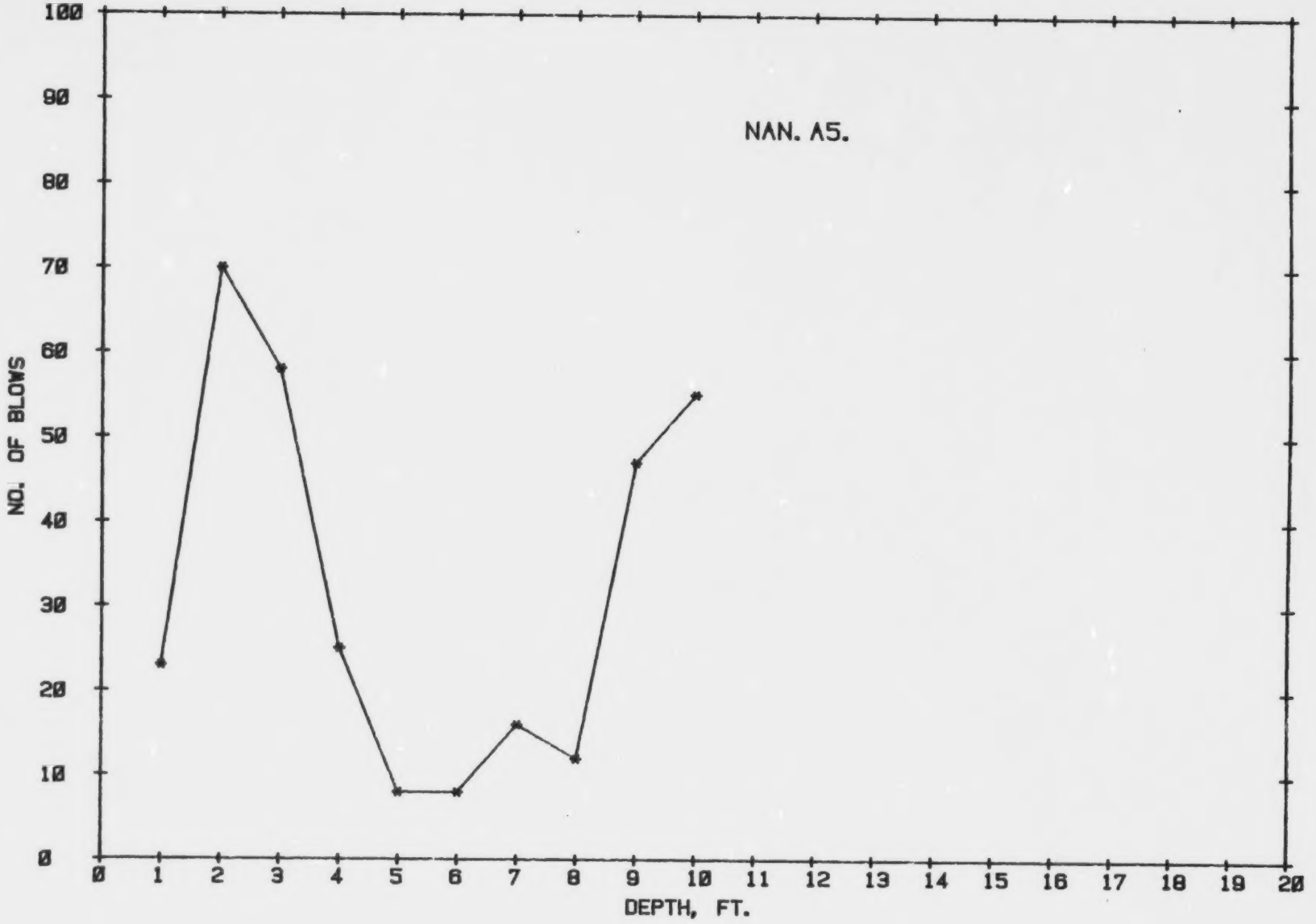
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. A5.
NO. OF BLOWS
DEPTH, FT.
100
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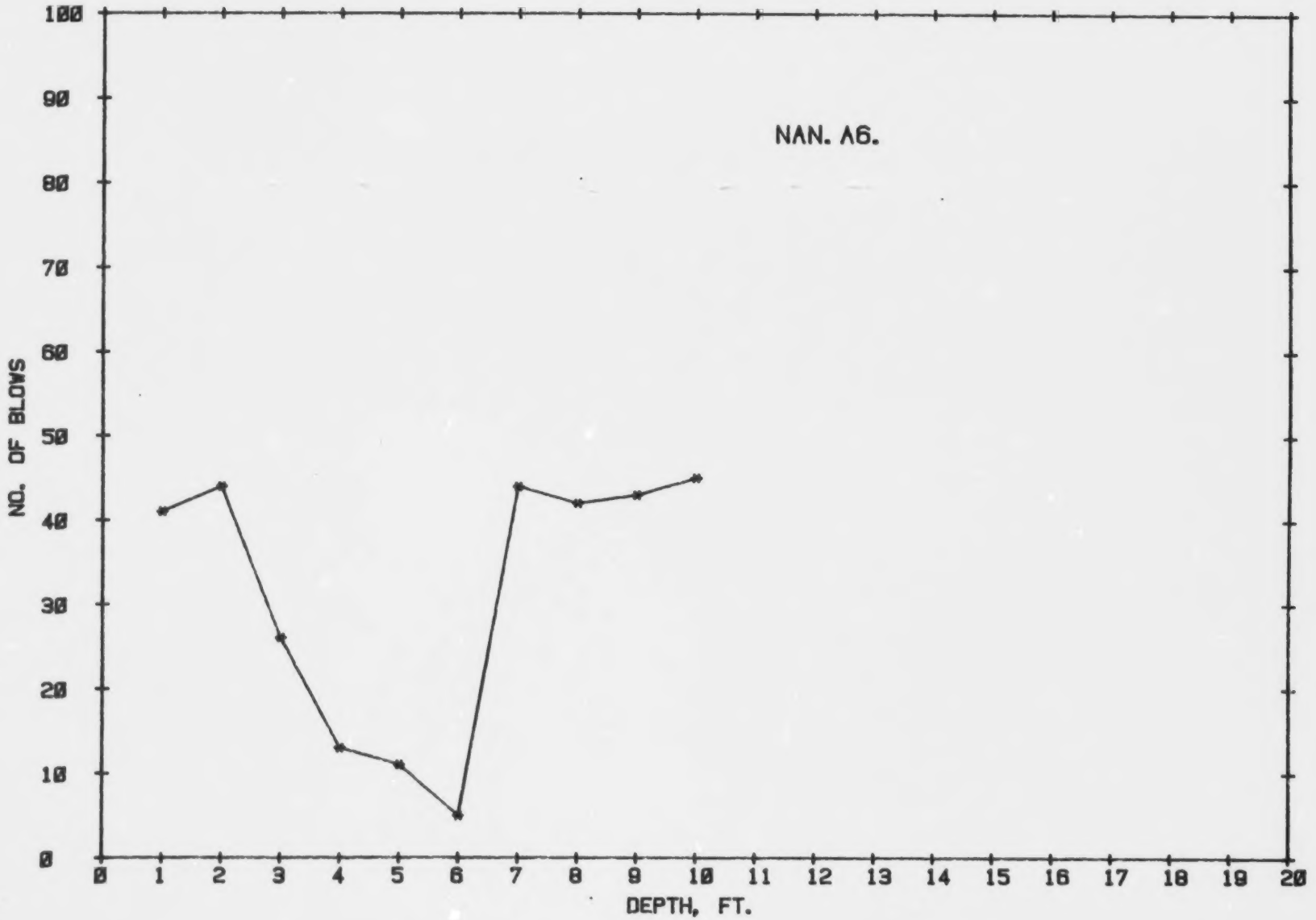
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20


NAN. A6.
NO. OF BLOWS
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80
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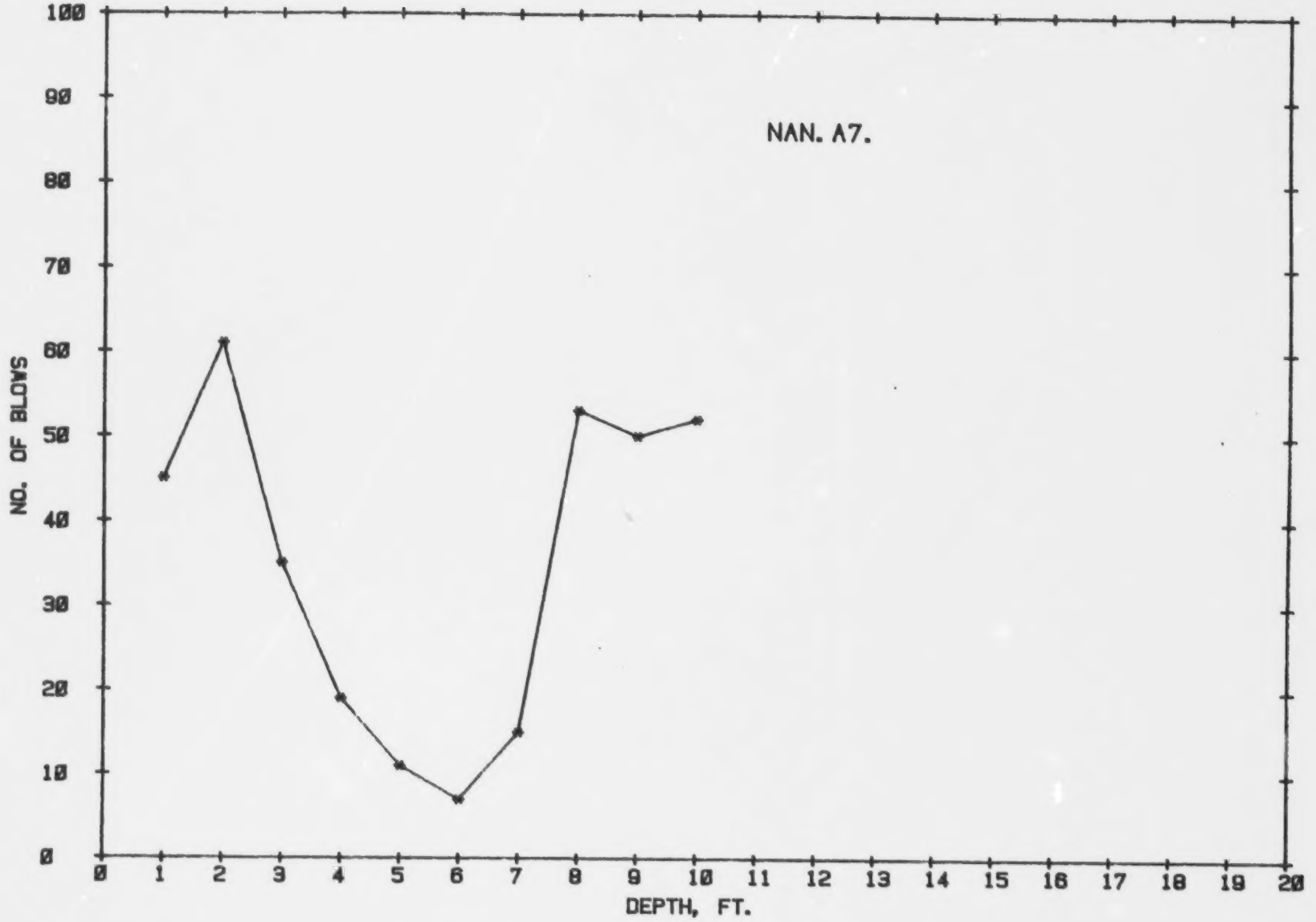
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. A7.
NO. OF BLOWS
100
90
80
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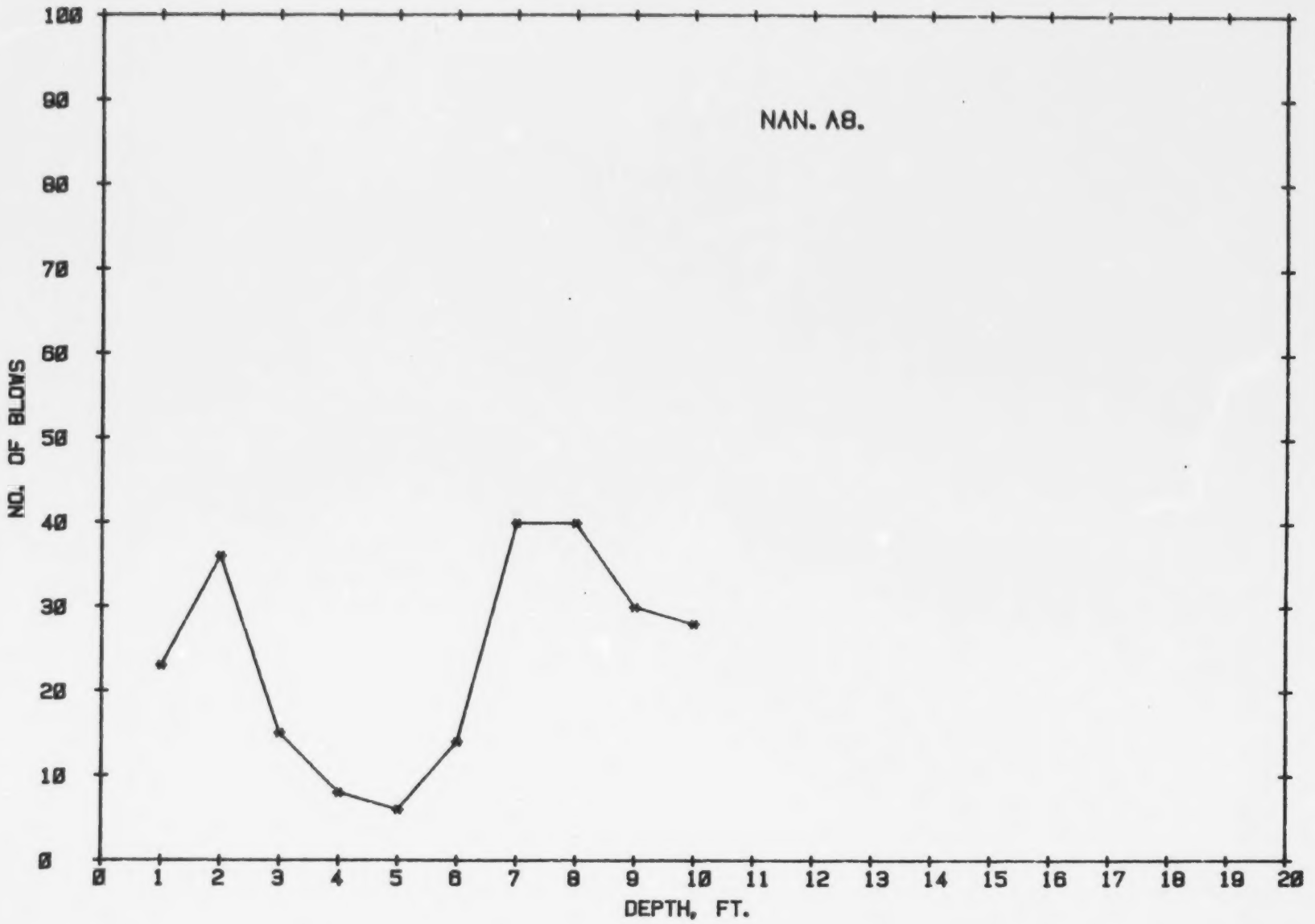
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. A8.
NO. OF BLOWS
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20
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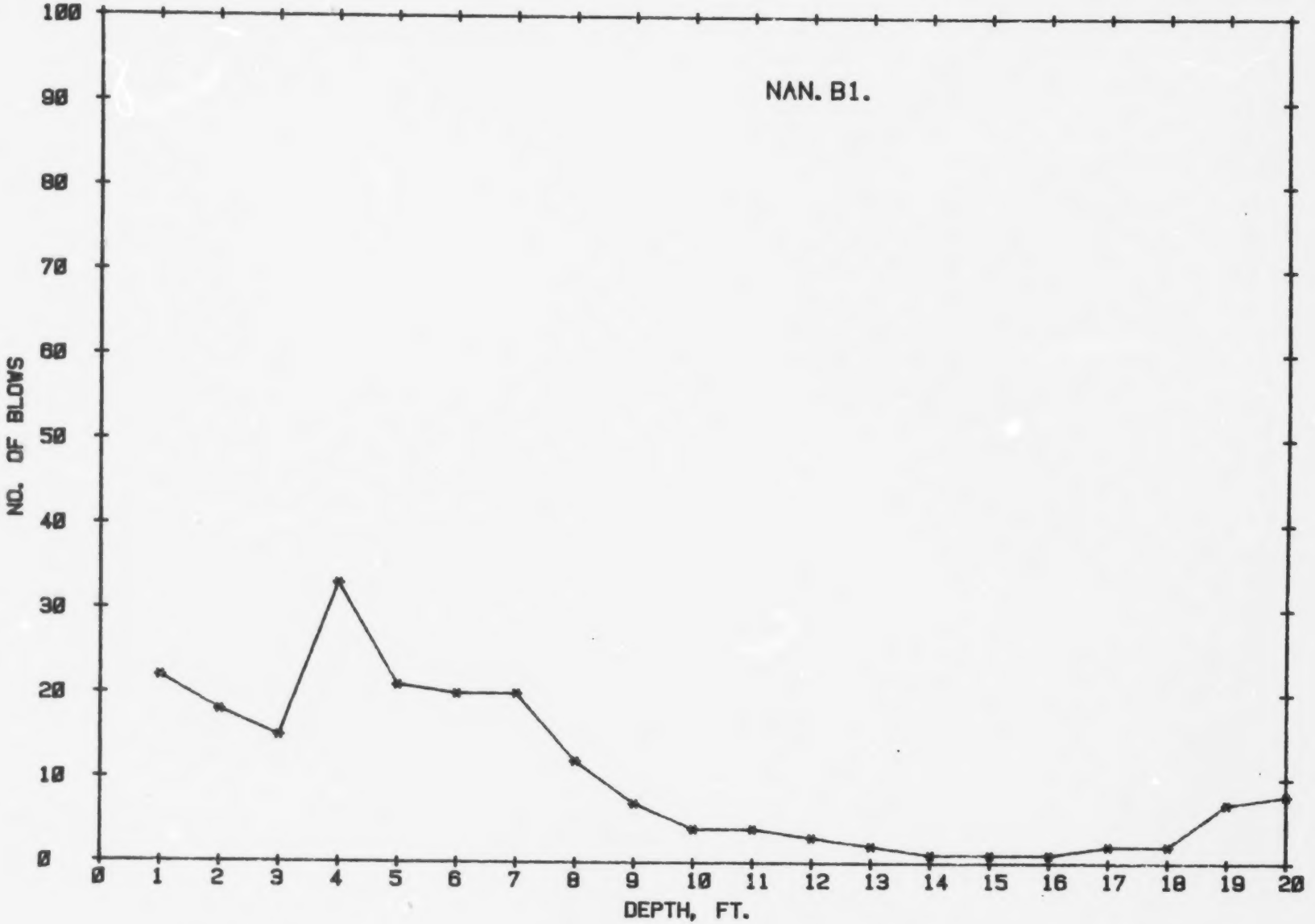
40
50
60
70
80
90
100
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. B1.
NO. OF BLOWS
100
90
80
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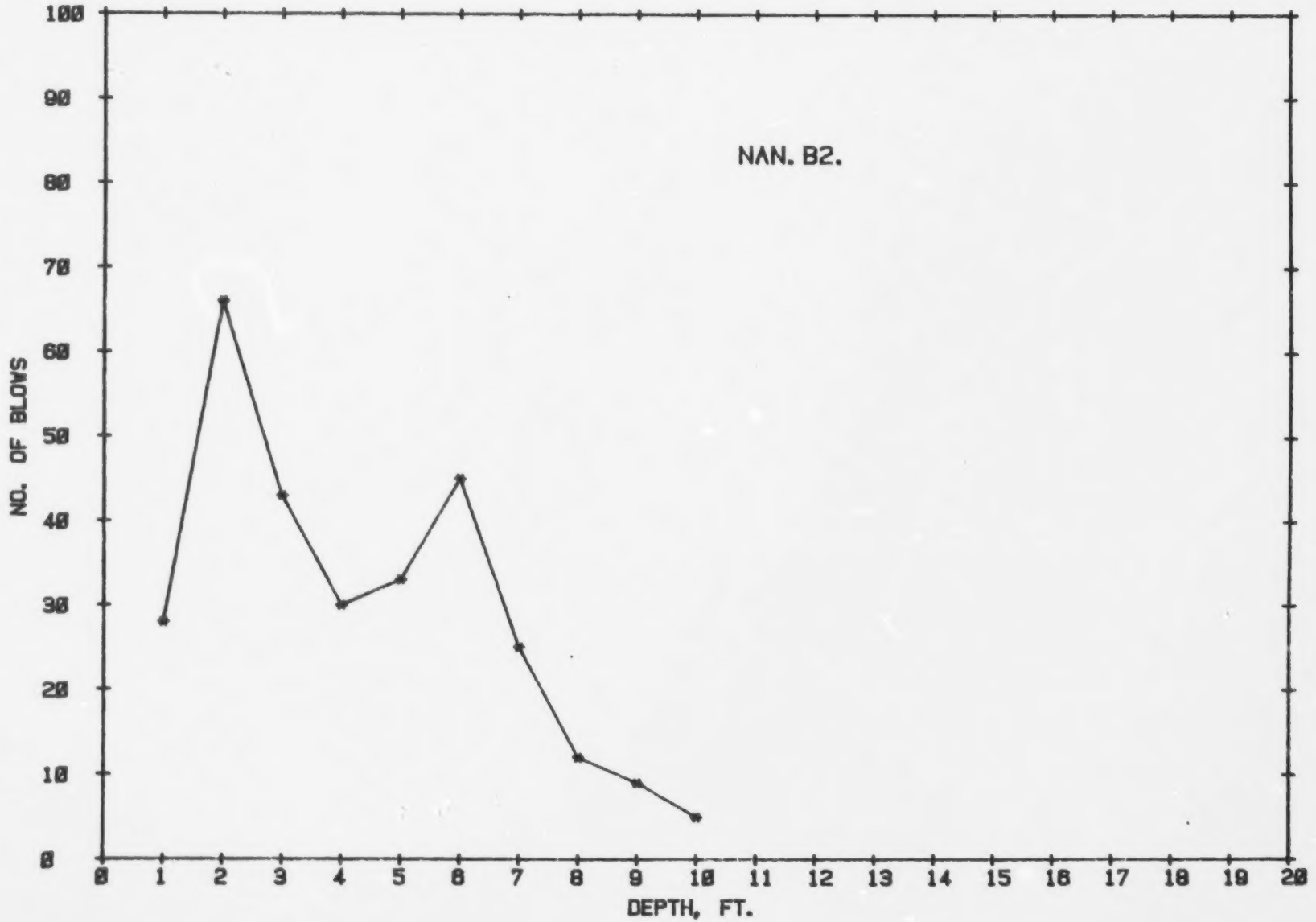
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. B2.
NO. OF BLOWS
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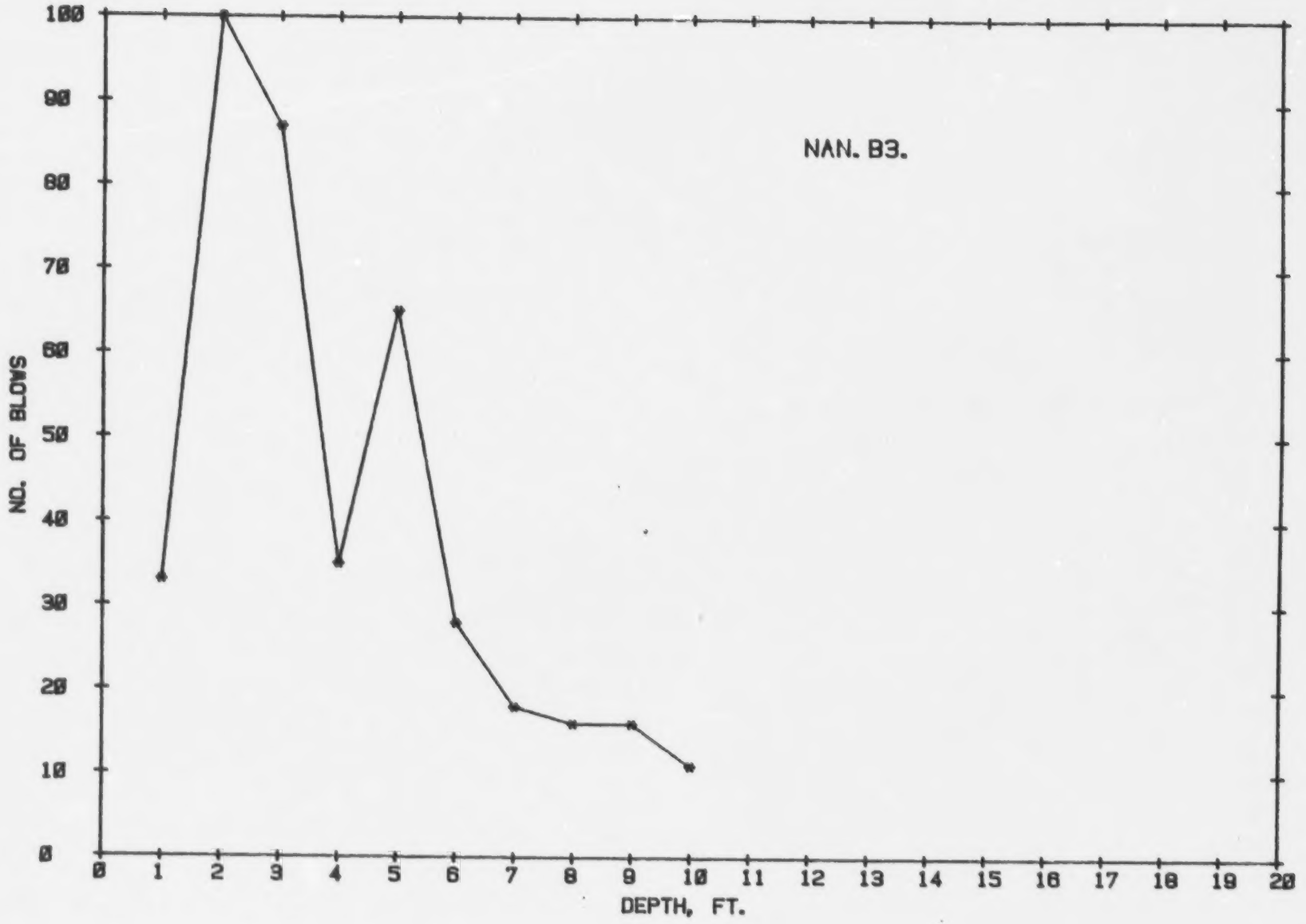
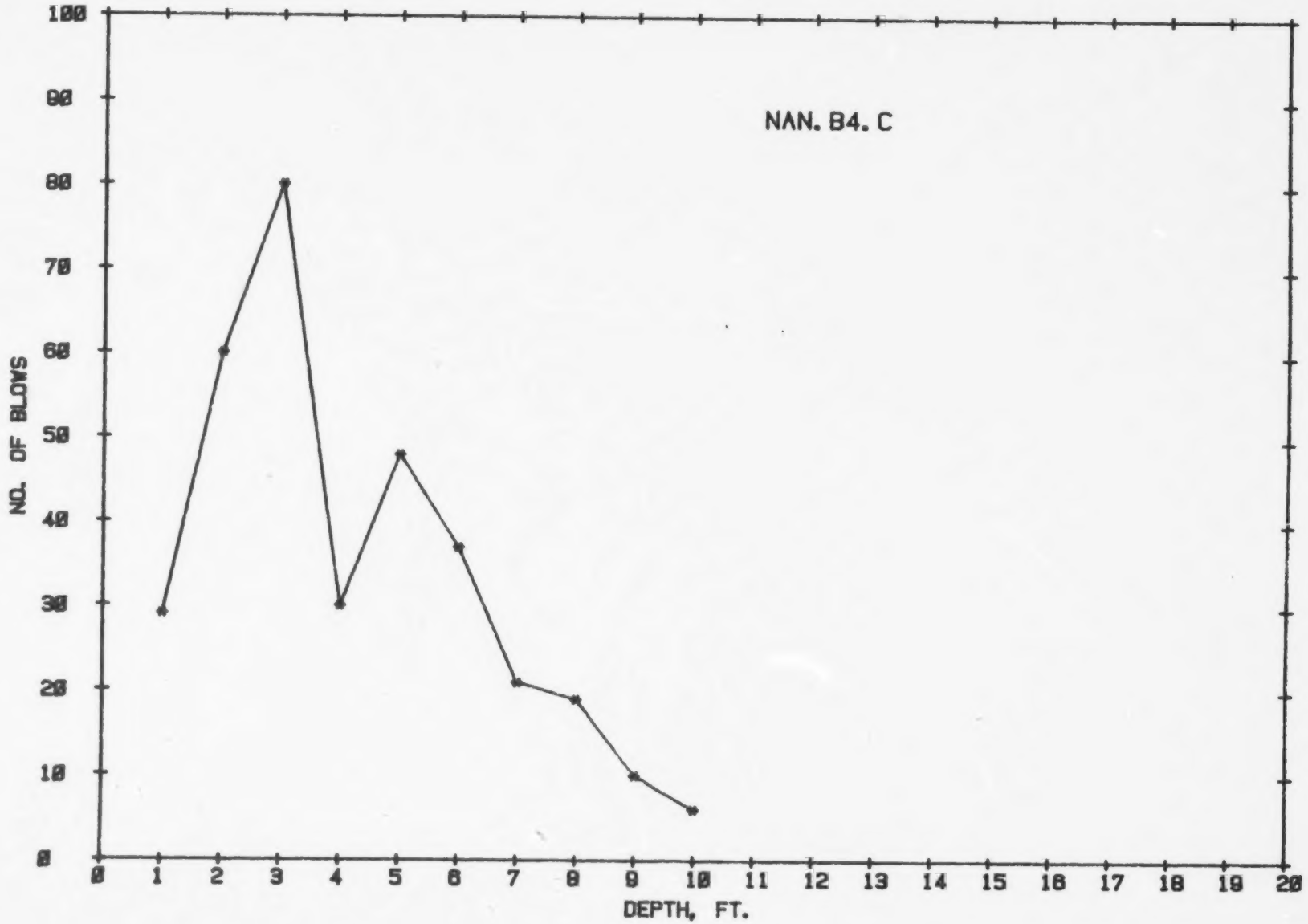
10
20
30
40
50
60
70
80
90
100
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. B3.
NO. OF BLOWS
100
90
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. B4. C
NO. OF BLOWS
100
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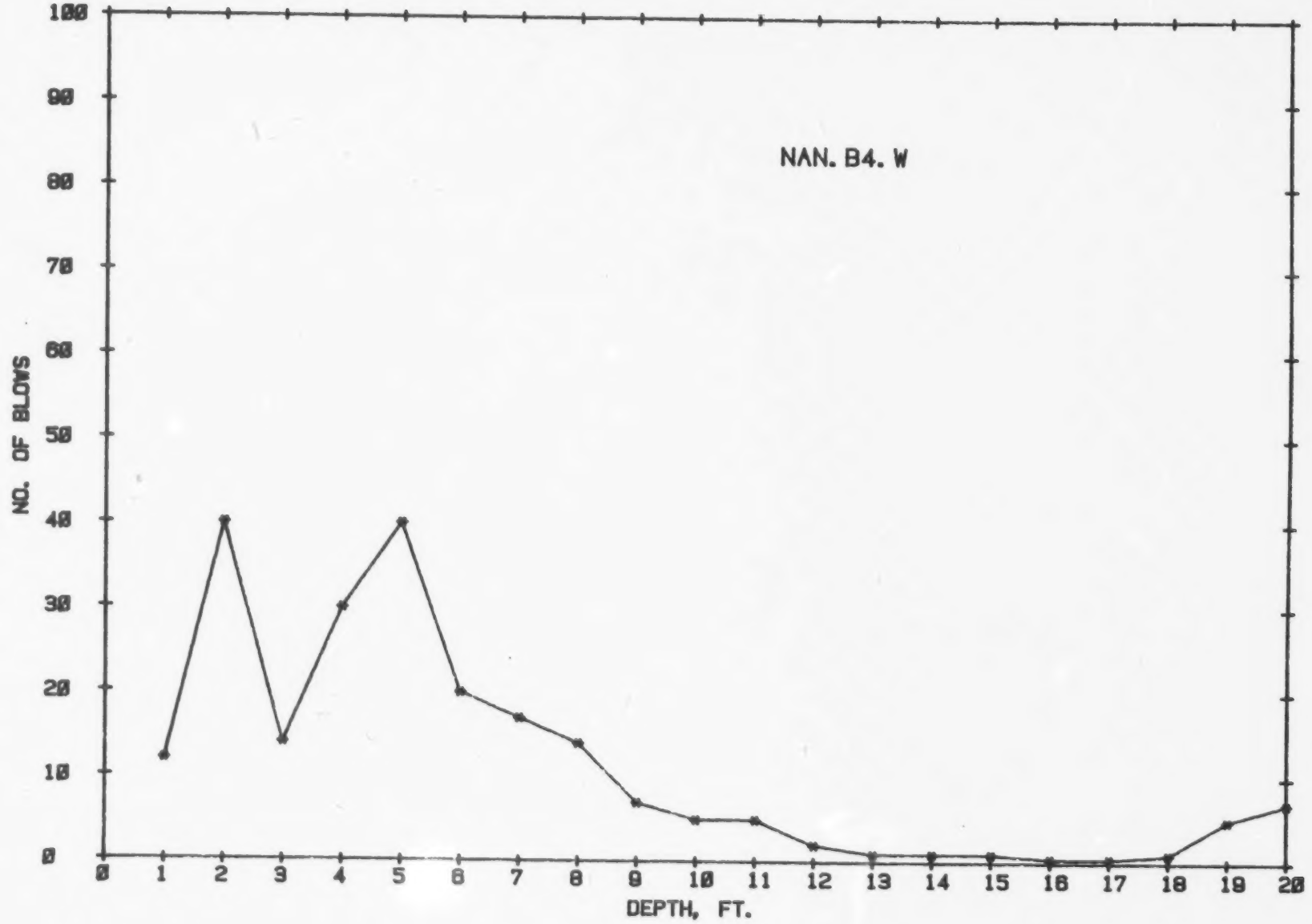
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. B4. W
NO. OF BLOWS
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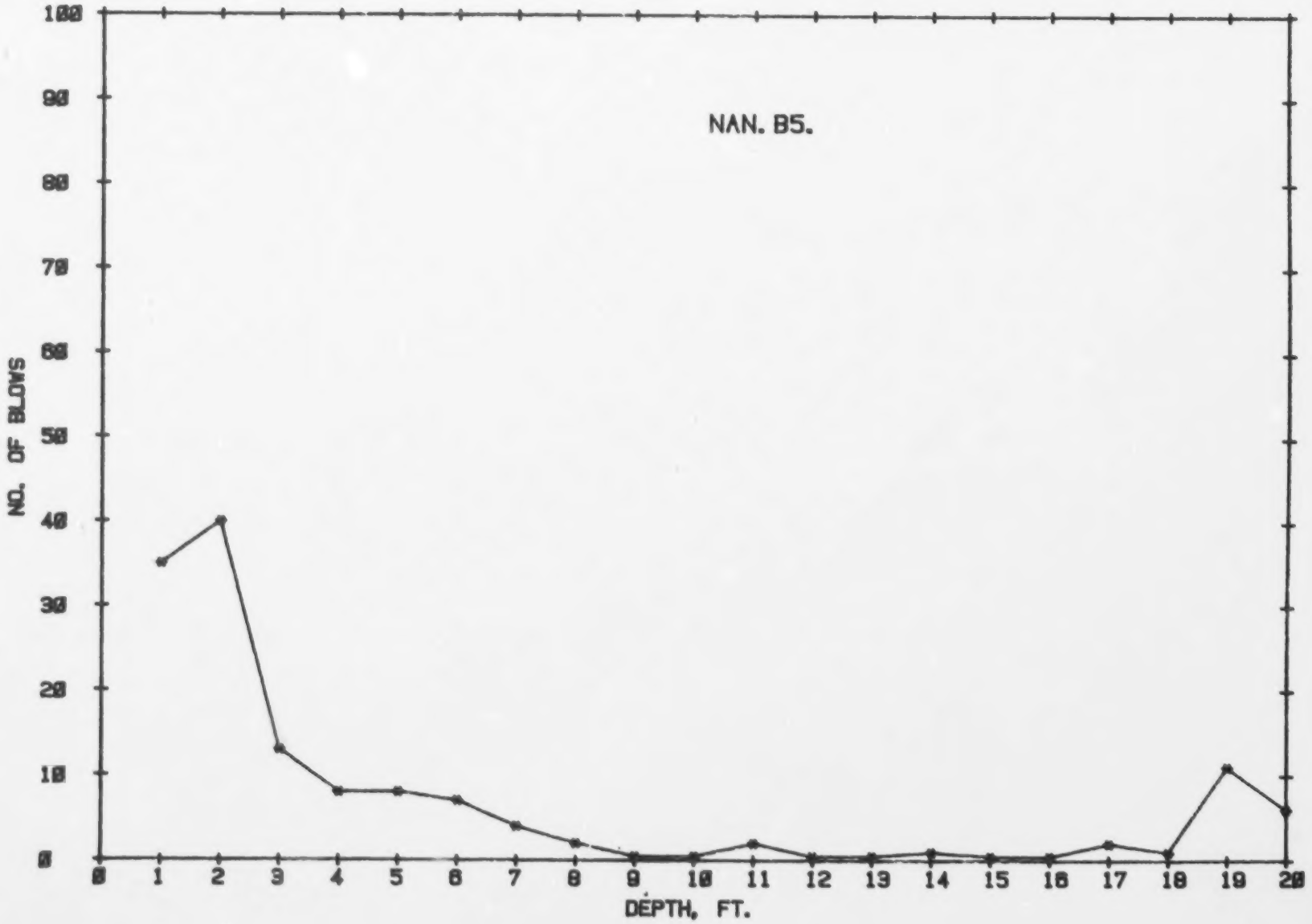
20
30
40
50
60
70
80
90
100
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. B5.
NO. OF BLOWS
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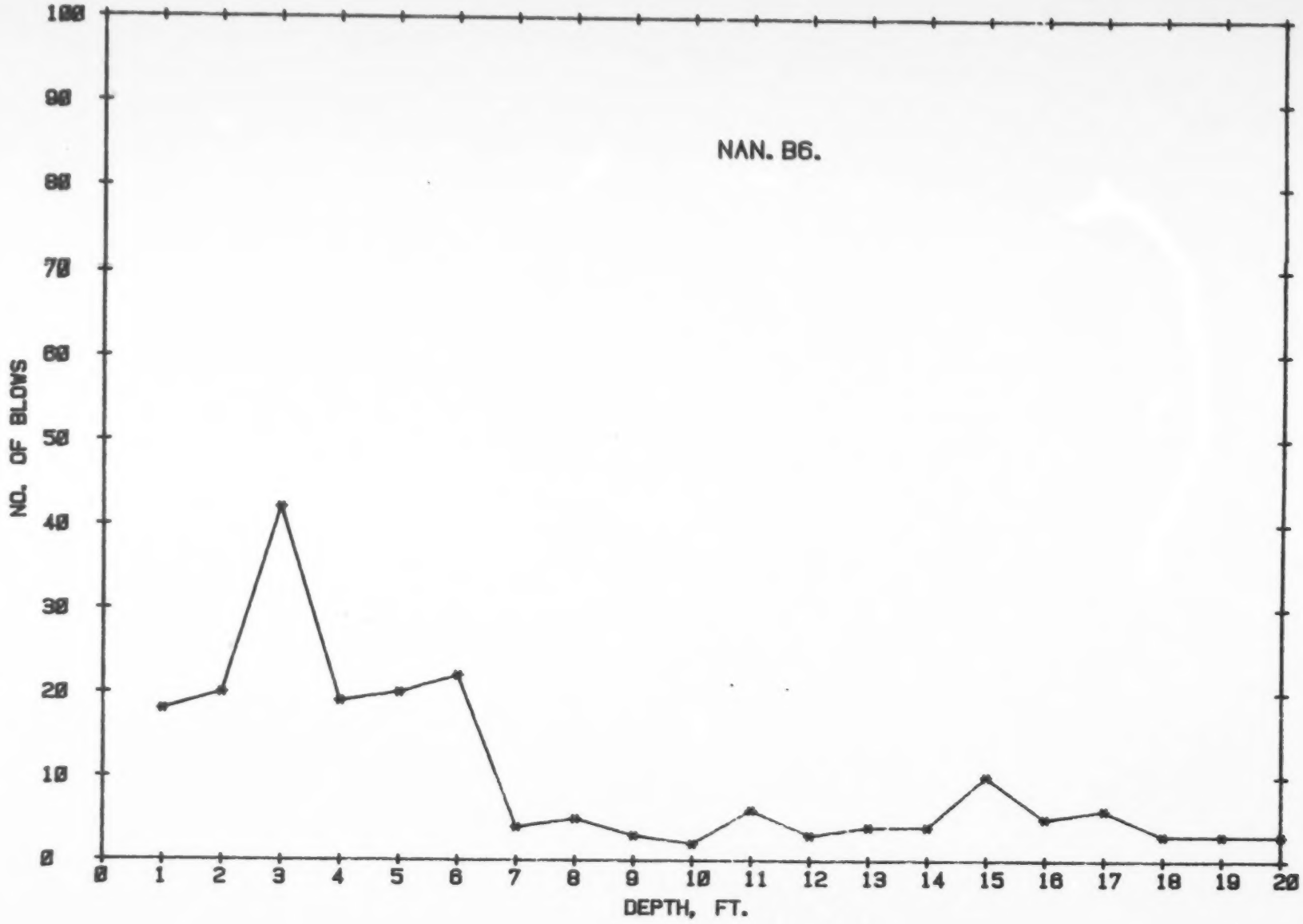
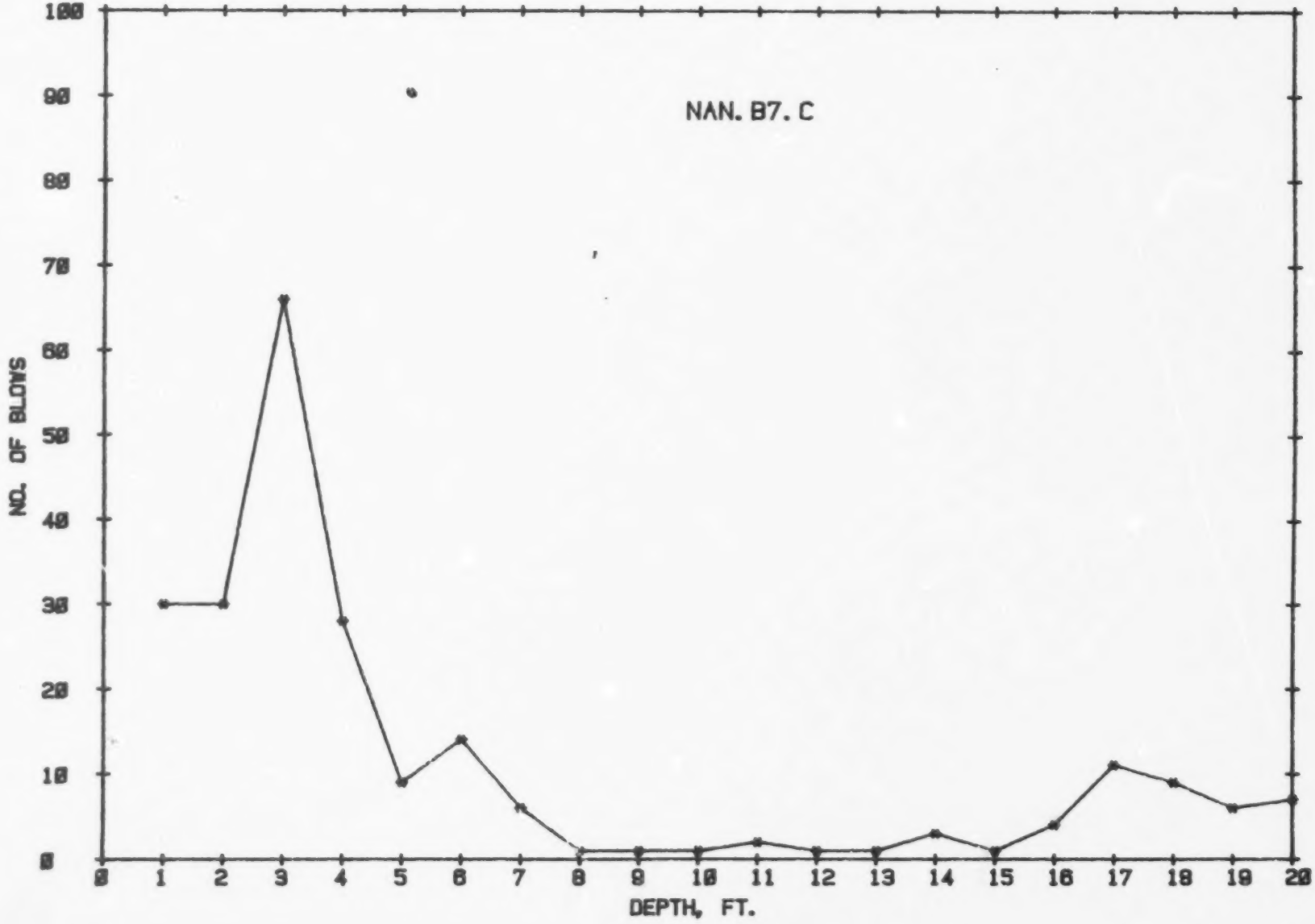
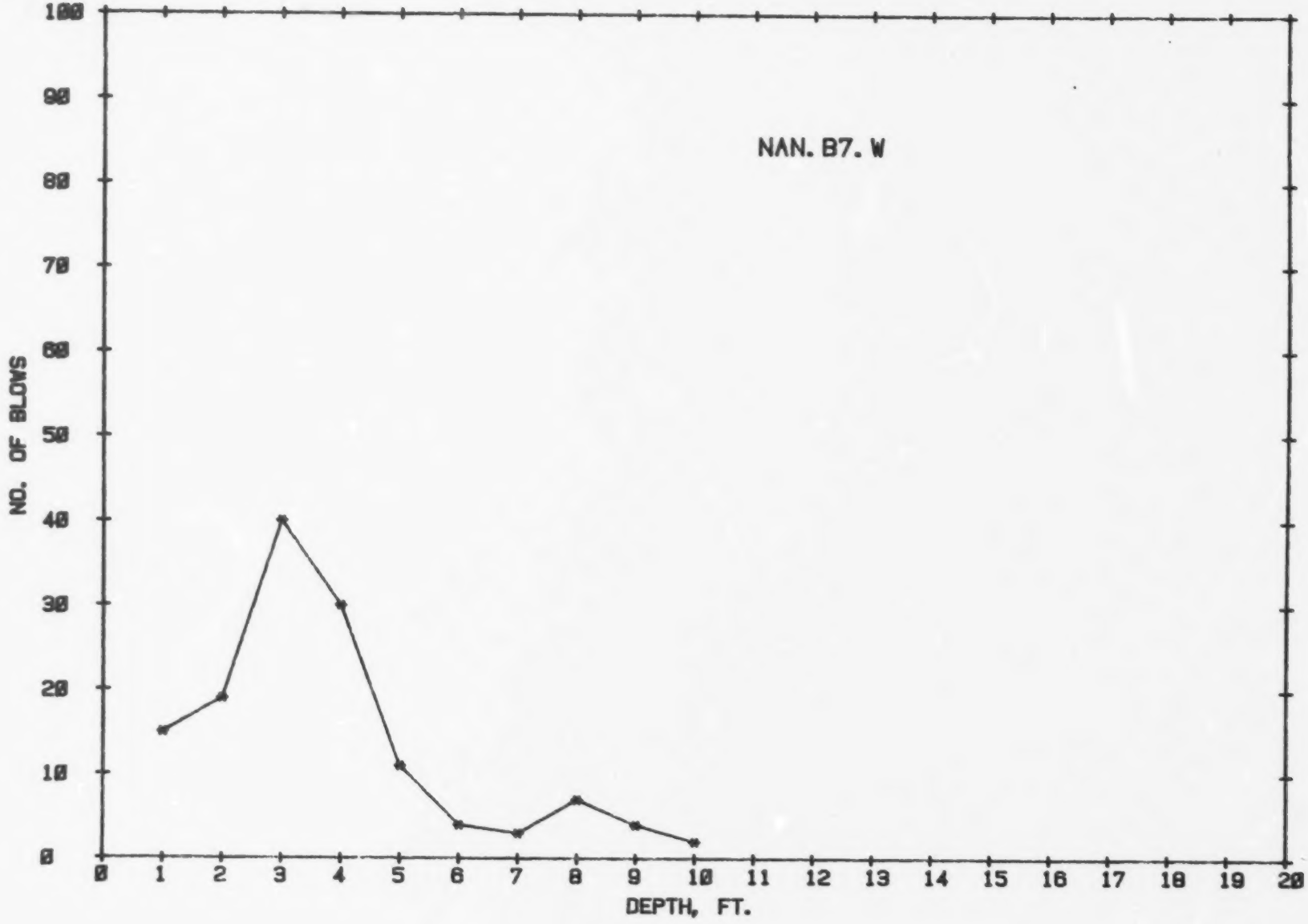
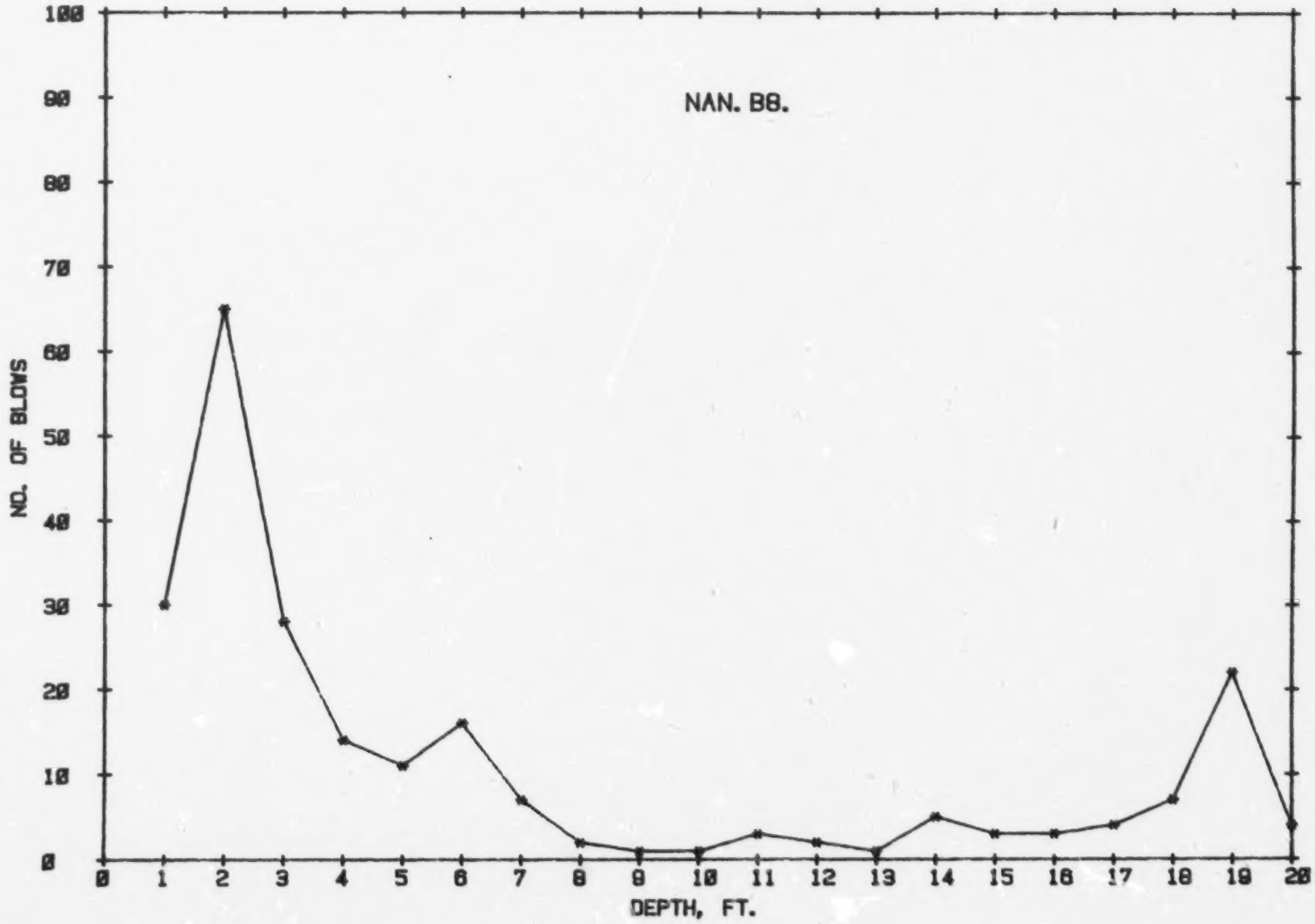
90
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. B6.
NO. OF BLOWS
100
90
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. B7. C
NO. OF BLOWS
100
90
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. B7. W
NO. OF BLOWS
DEPTH, FT.
0
10
20
30
40
50
60
70
80
90
100
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20


NAN. B8.
NO. OF BLOWS
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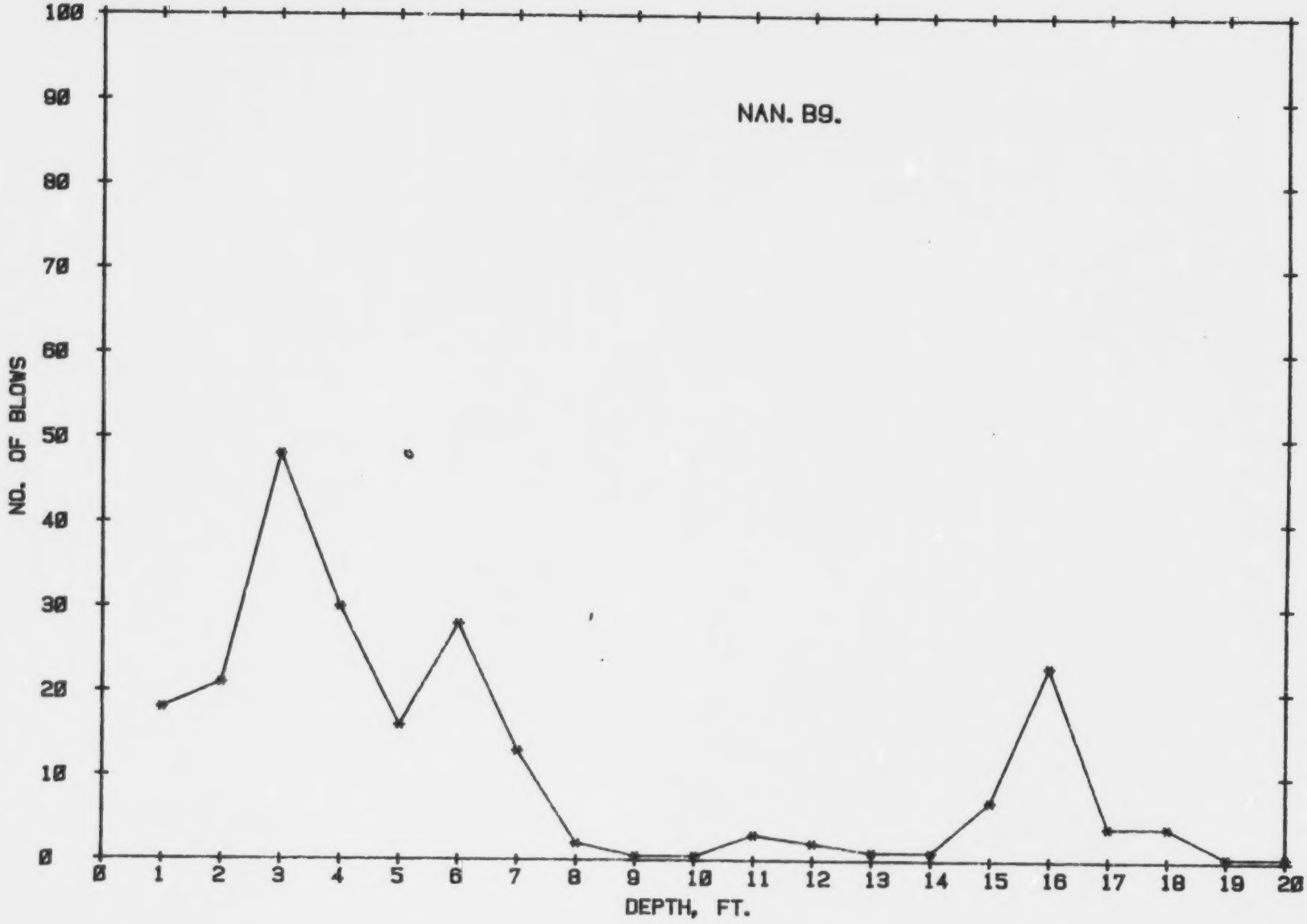
90
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. B9.
NO. OF BLOWS
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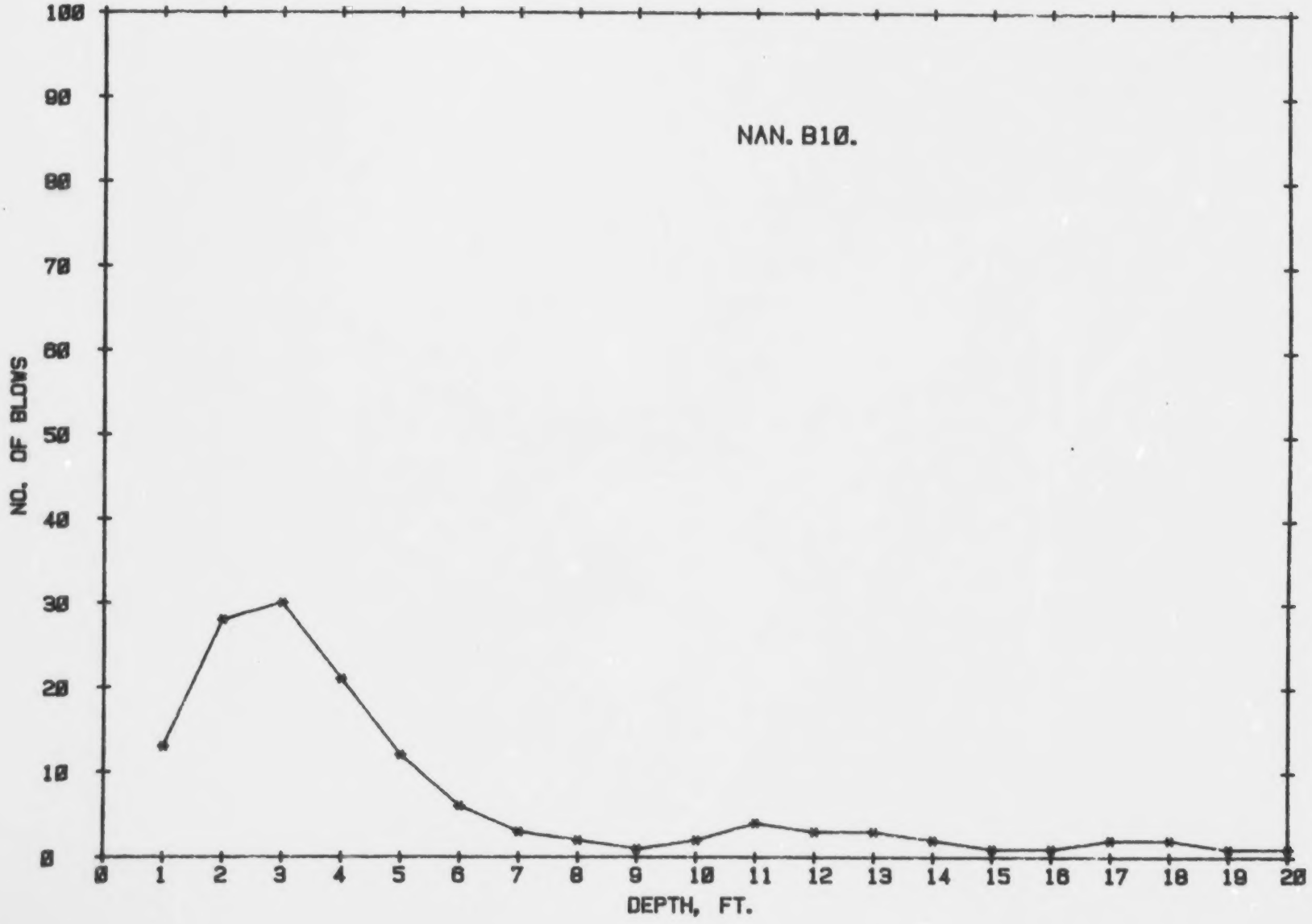
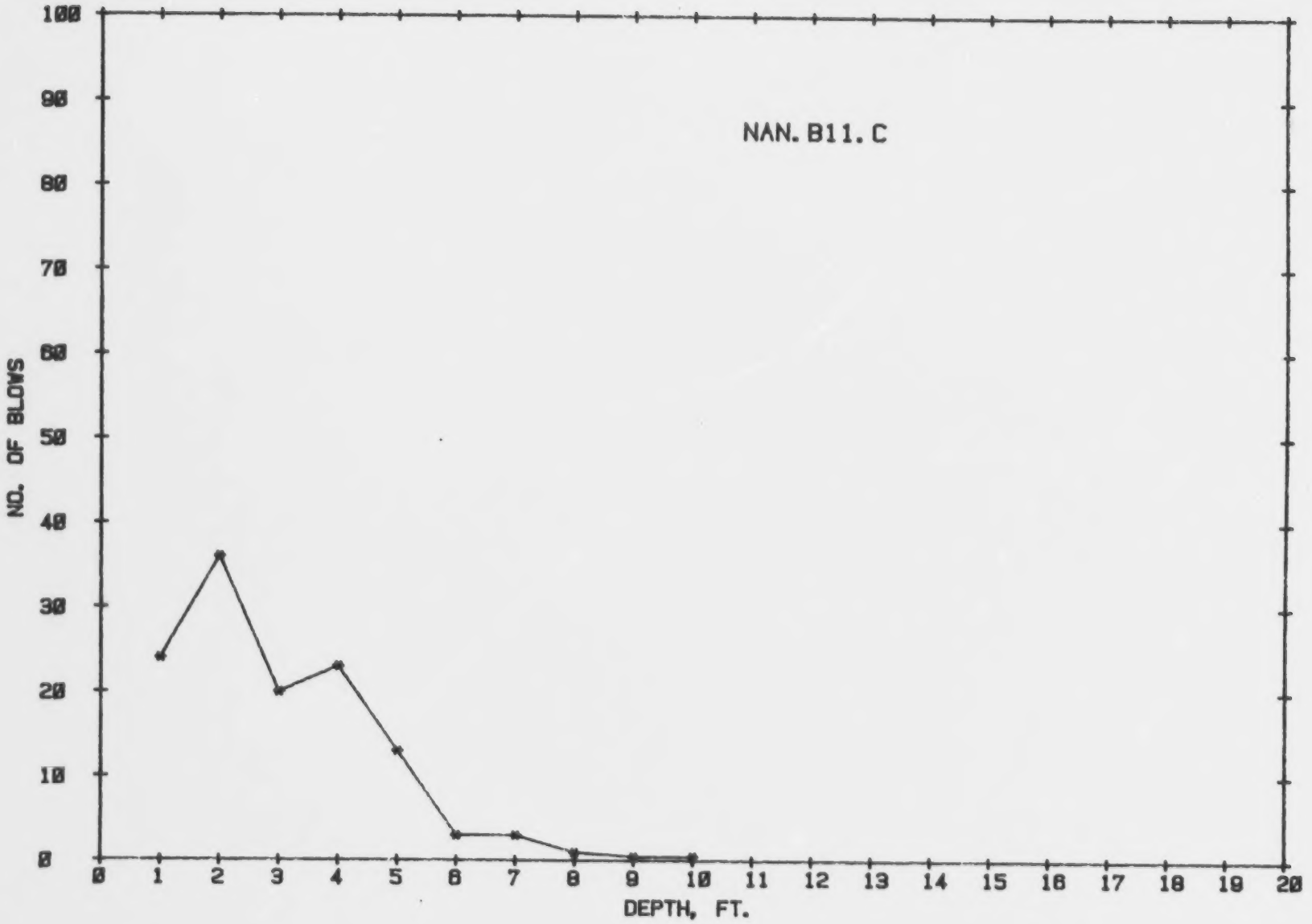
90
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. B10.
NO. OF BLOWS
100
90
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. B11. C
NO. OF BLOWS
100
90
80
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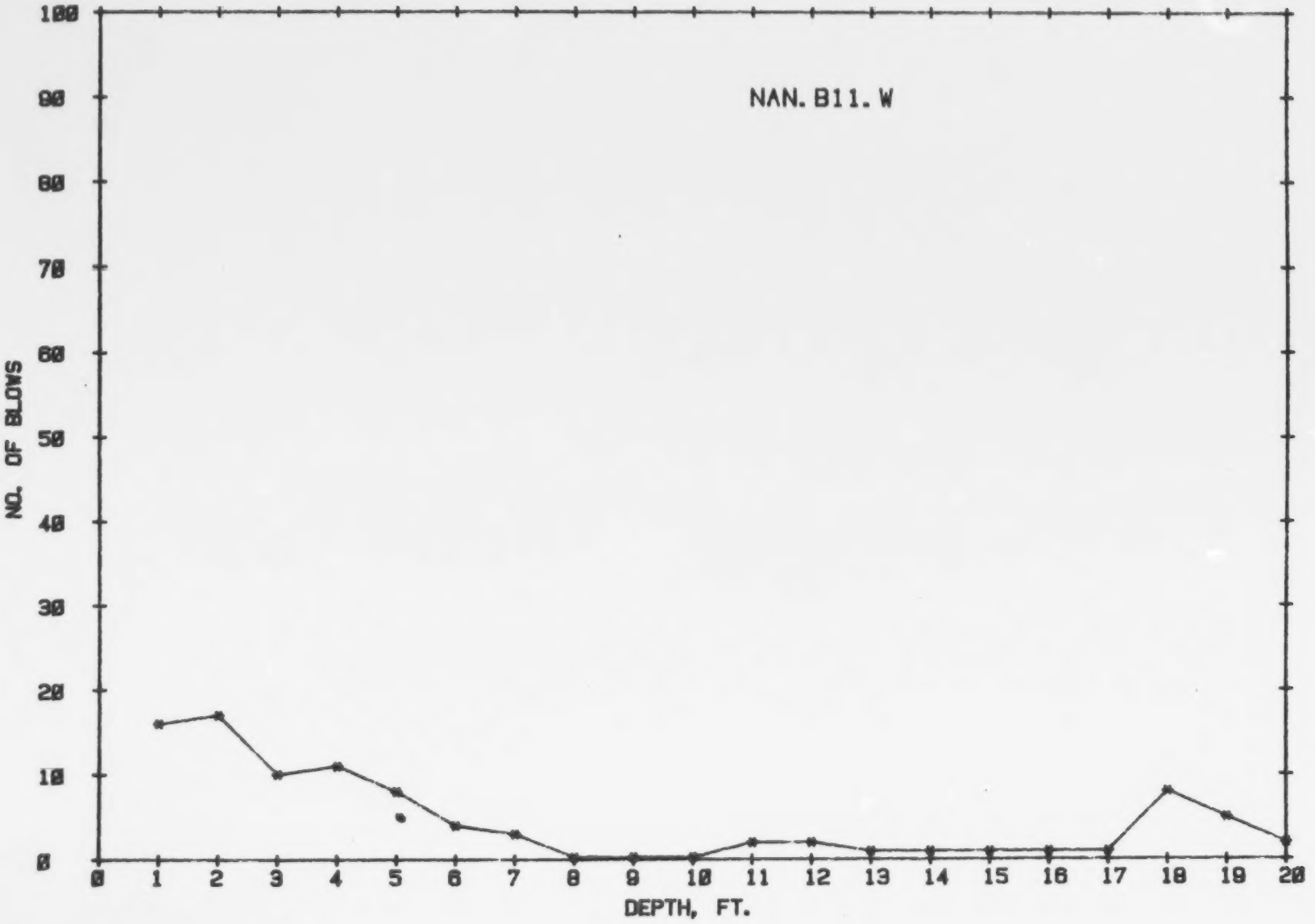
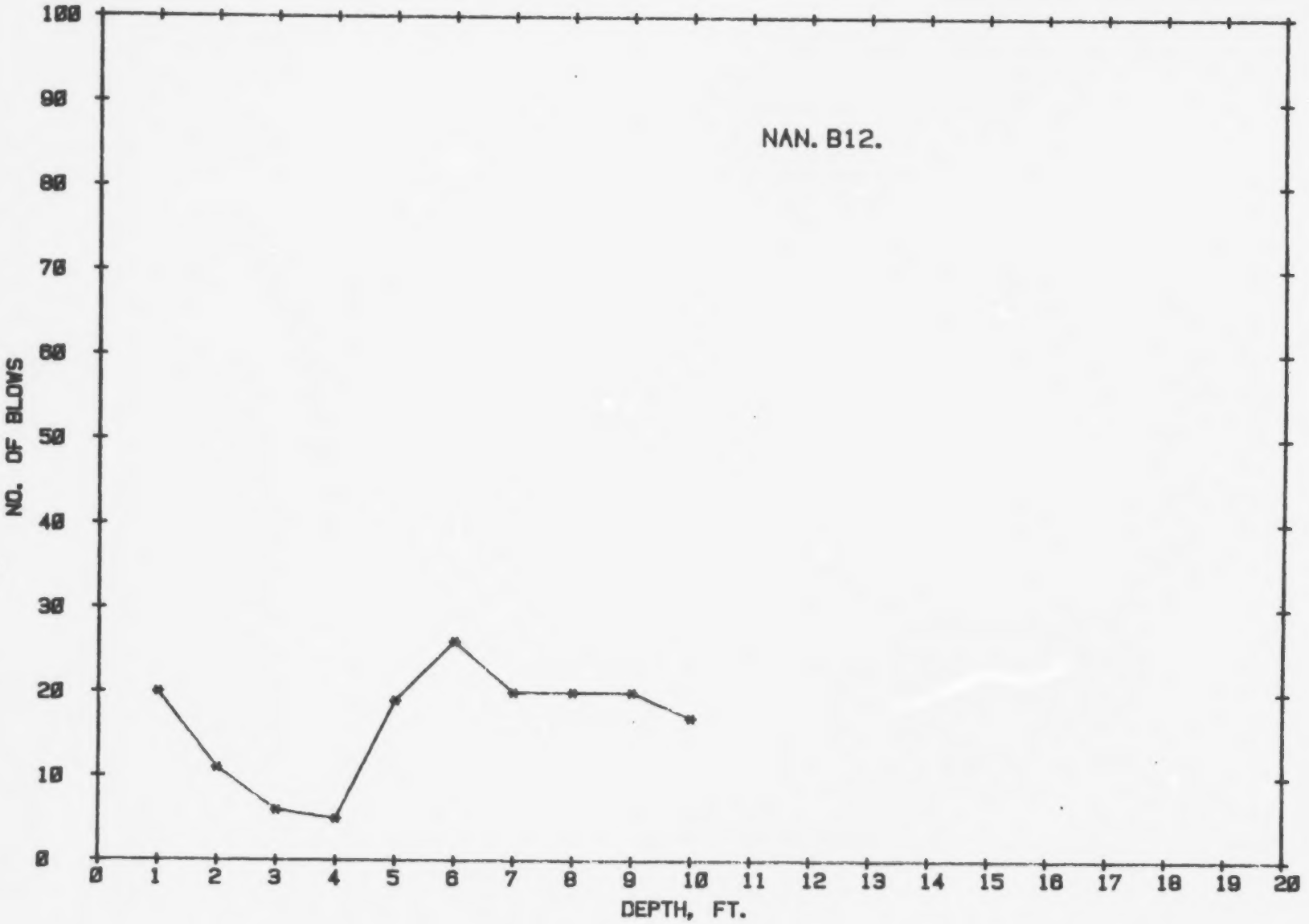
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. B11. W
NO. OF BLOWS
100
90
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. B12.
NO. OF BLOWS
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80
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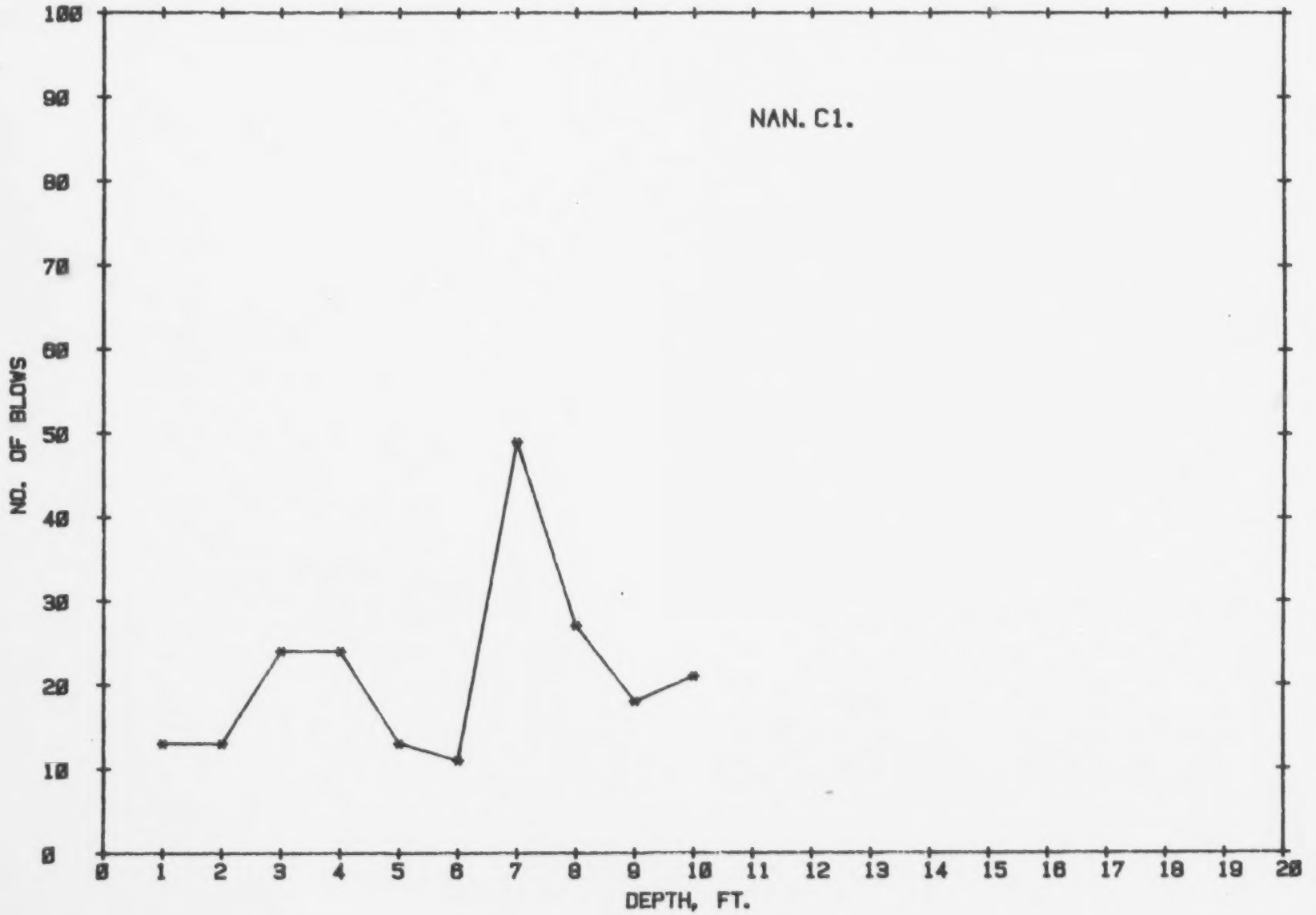
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. C1.
NO. OF BLOWS
DEPTH, FT.
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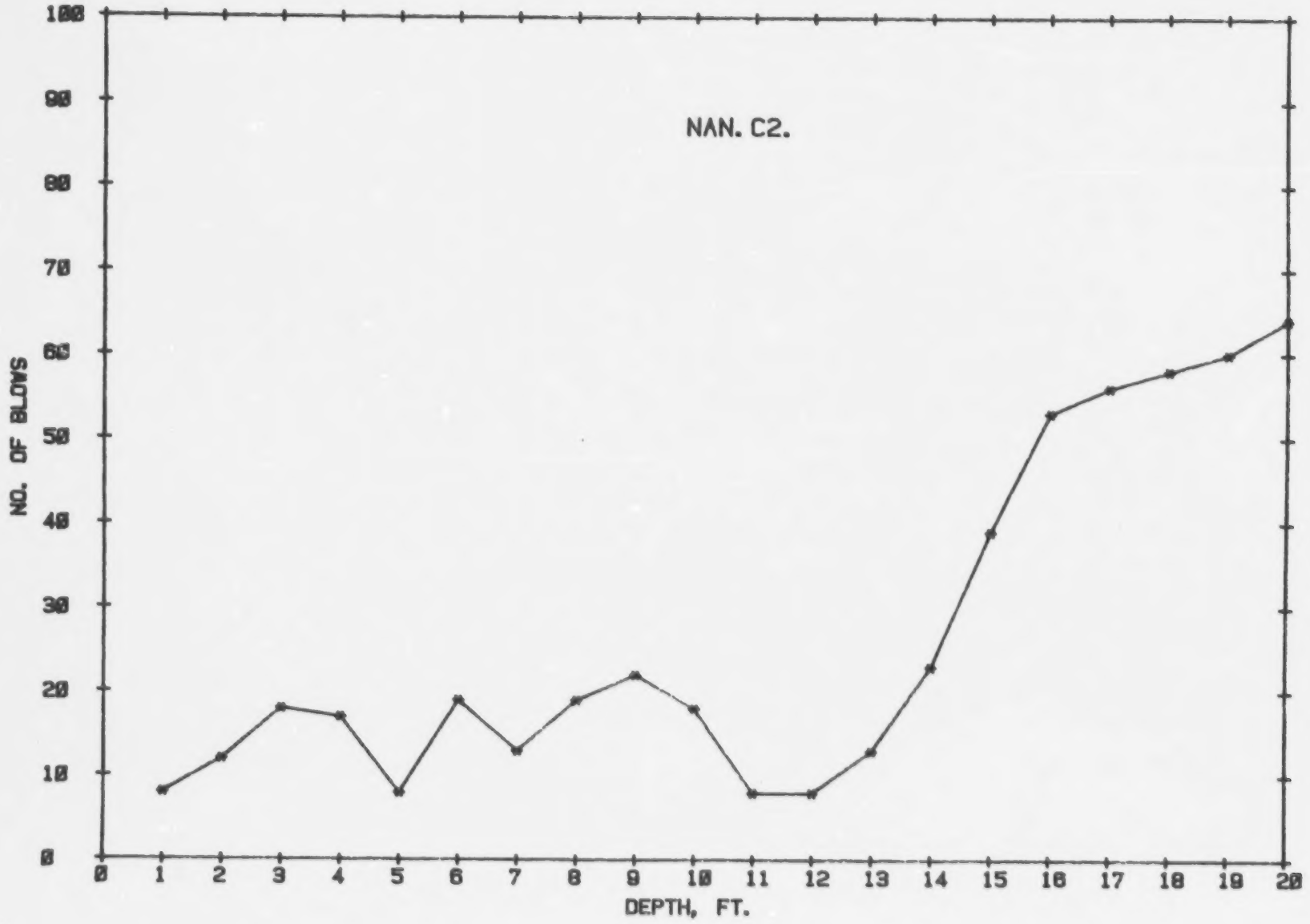
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20


NAN. C2.
NO. OF BLOWS
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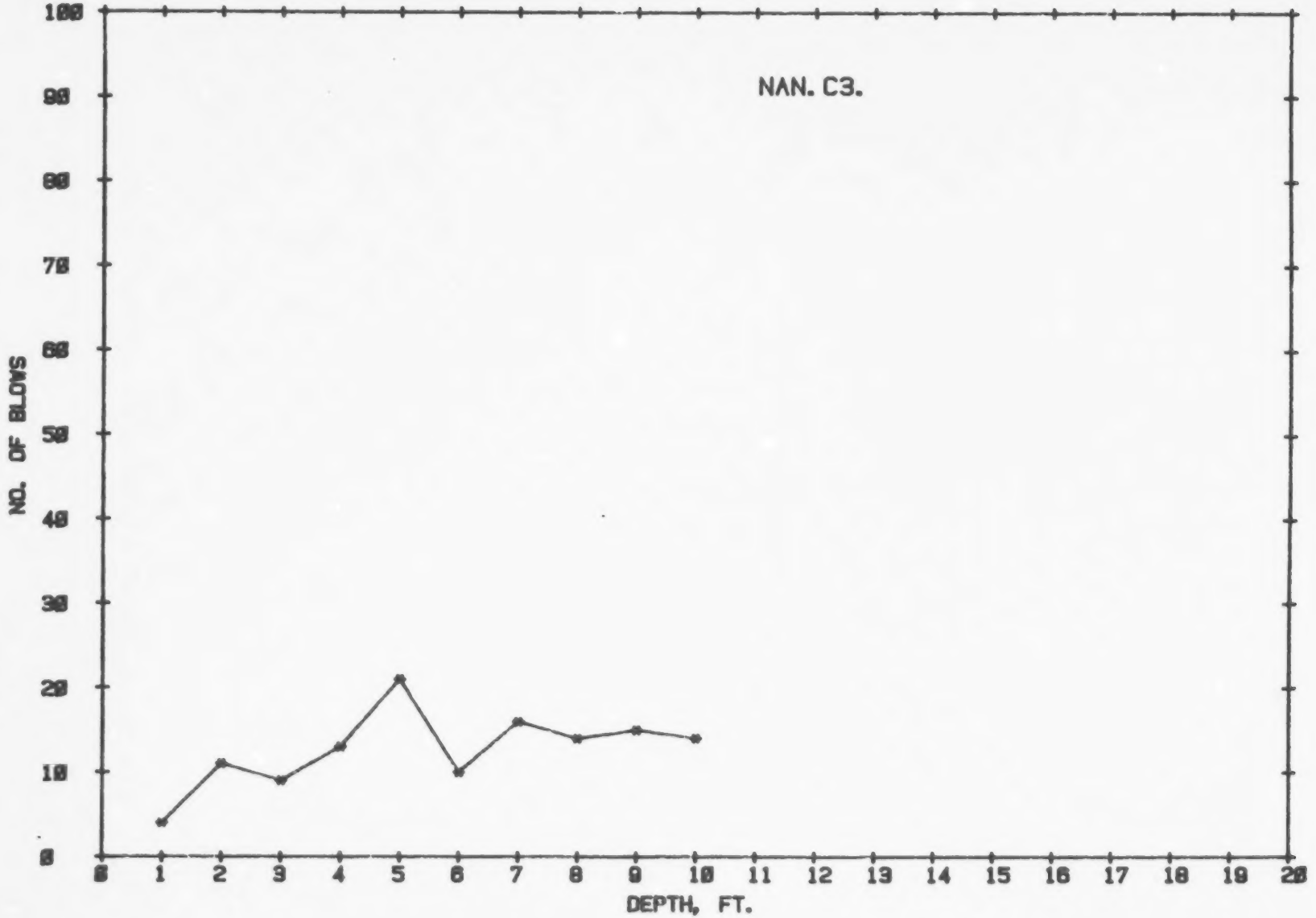
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. C3.
NO. OF BLOWS
100
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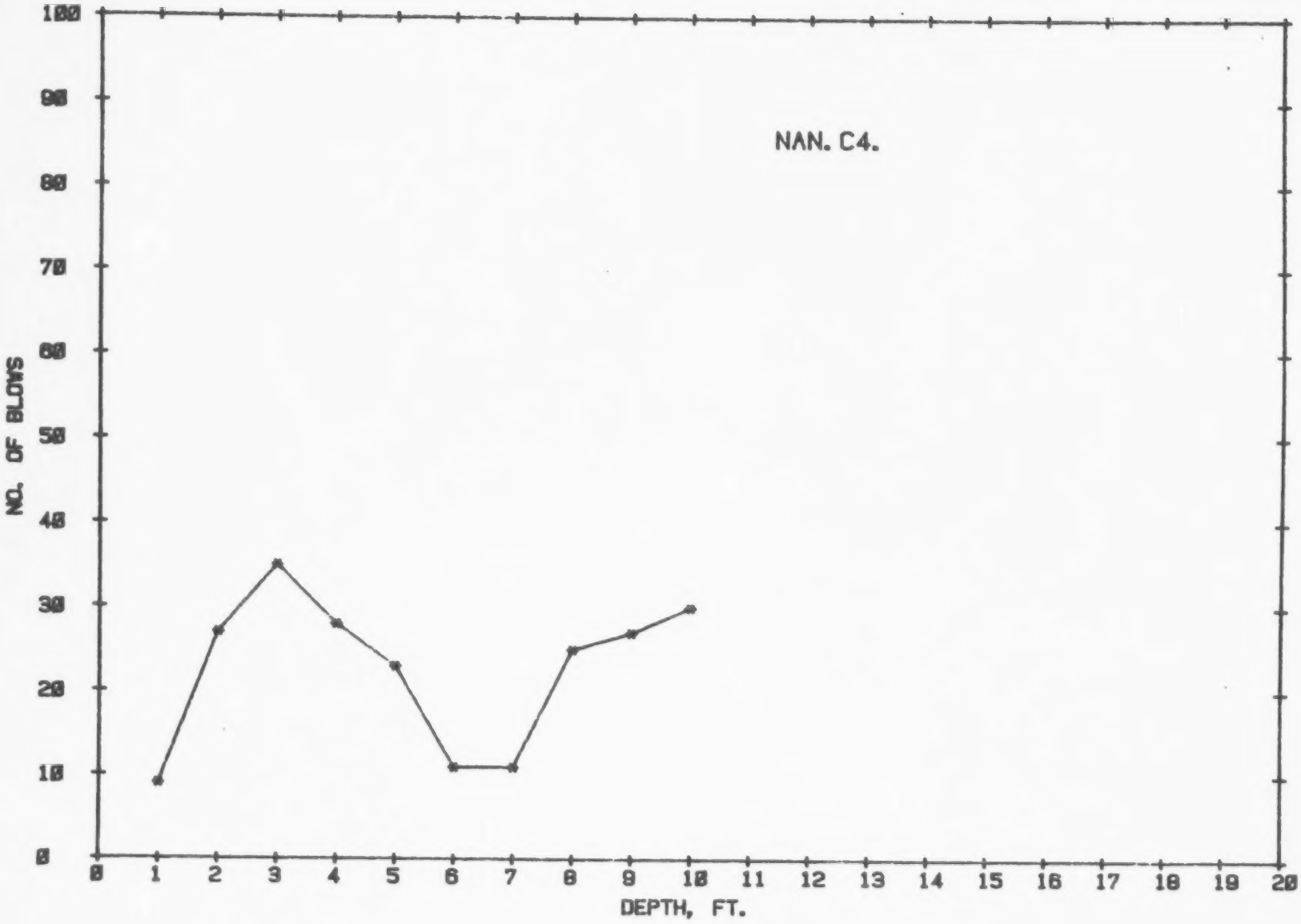
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. C4.
NO. OF BLOWS
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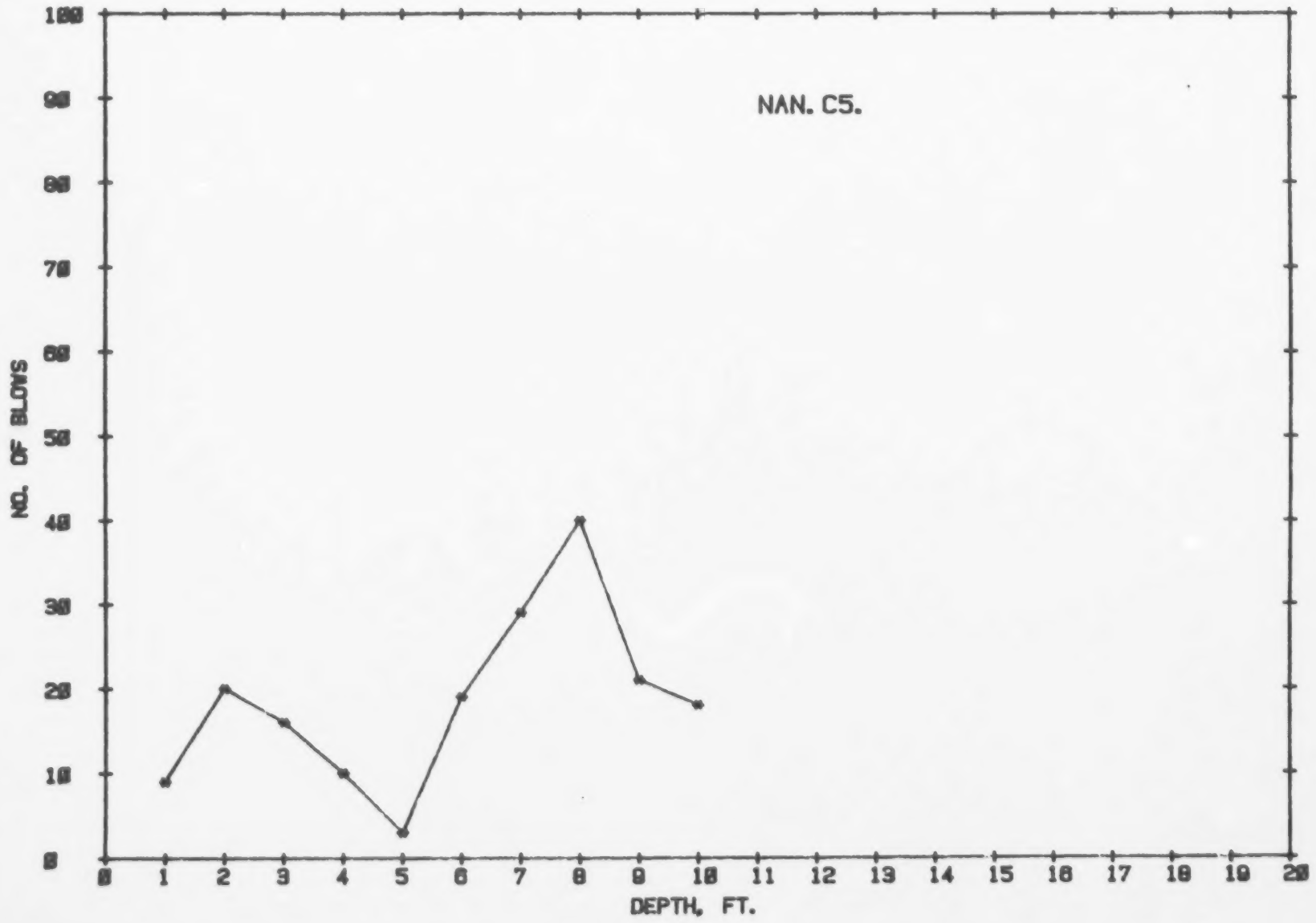
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. C5.
NO. OF BLOWS
100
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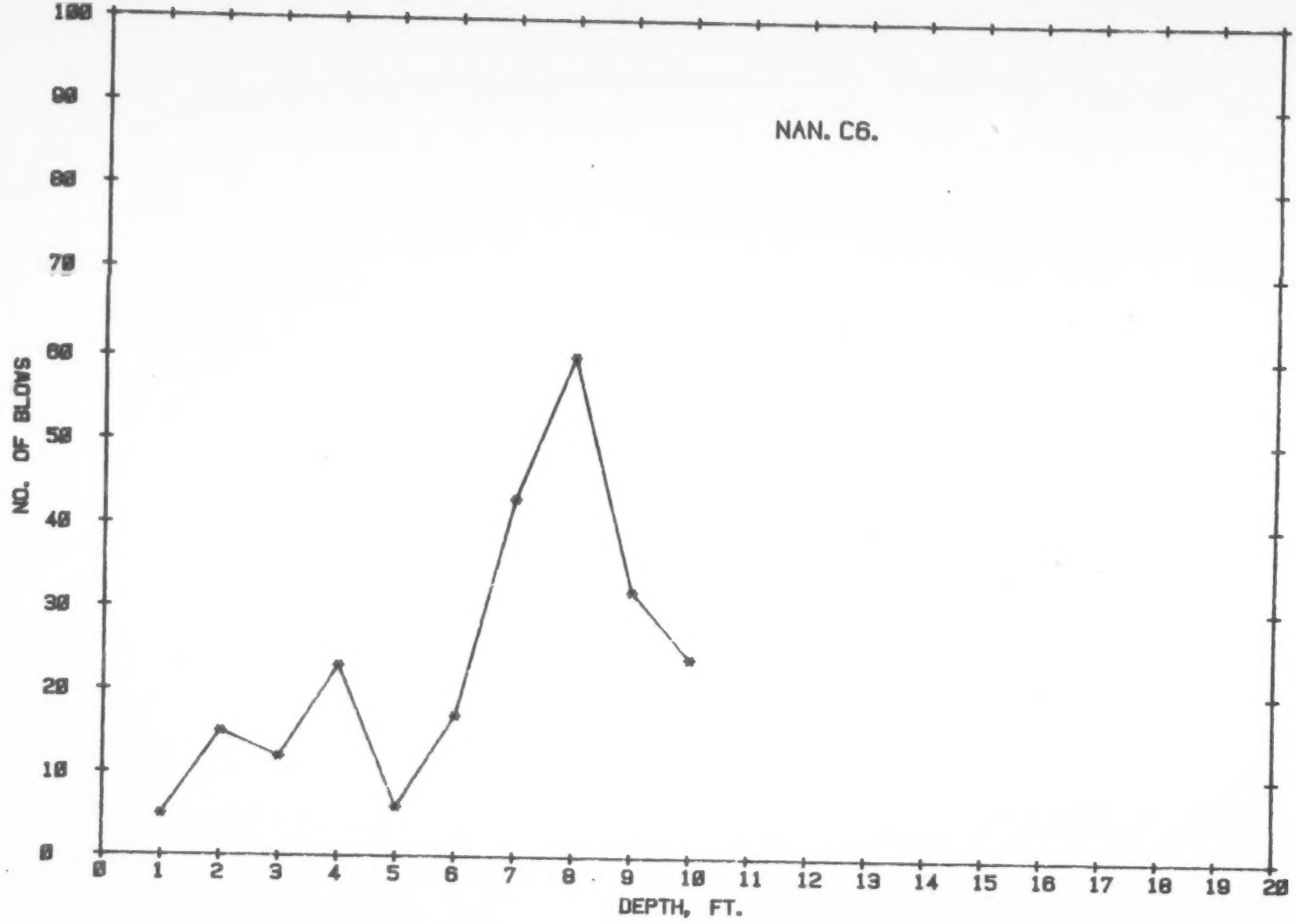
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. C6.
NO. OF BLOWS
100
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80
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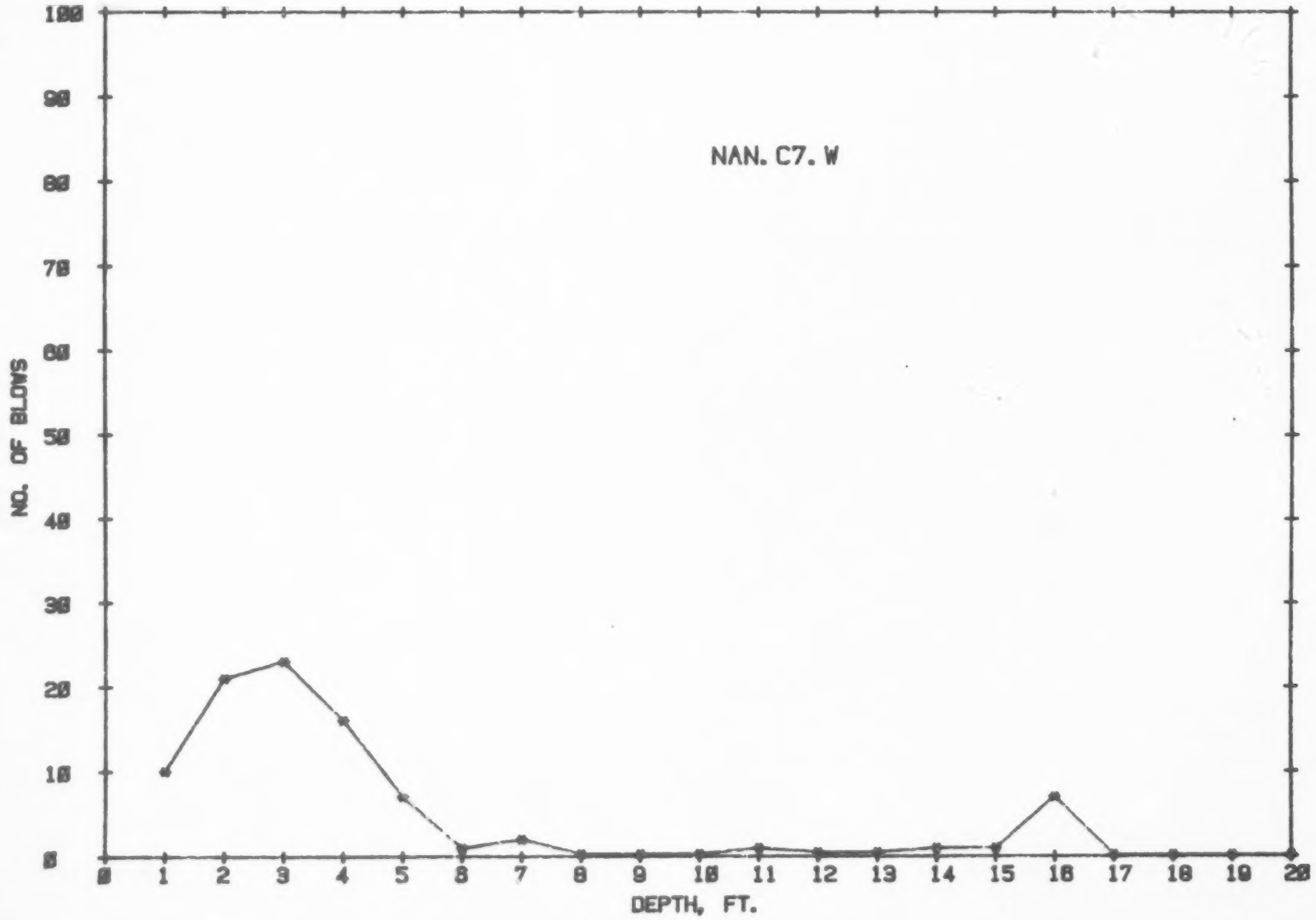
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. C7. W
NO. OF BLOWS
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80
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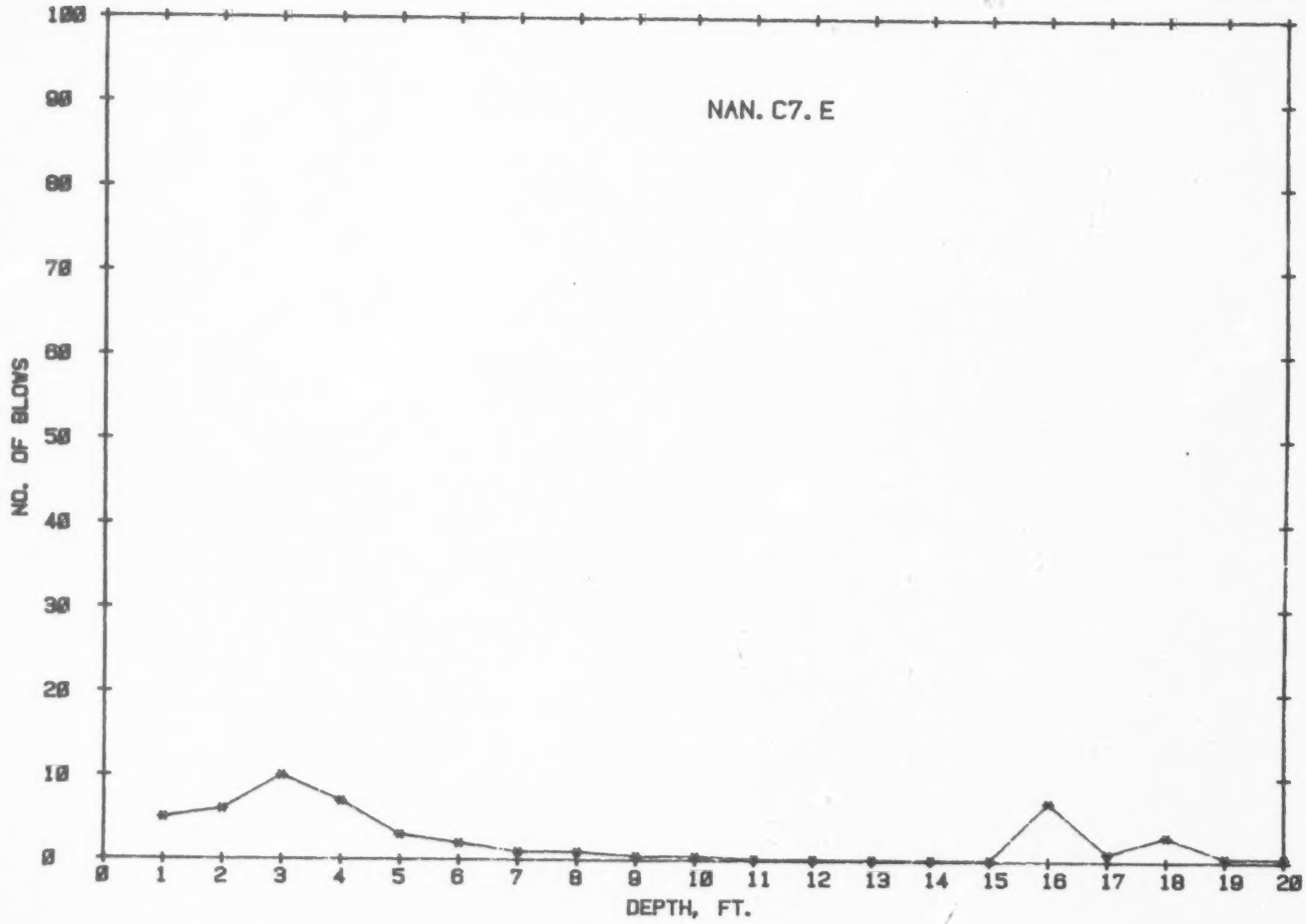
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. C7. E
NO. OF BLOWS
100
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80
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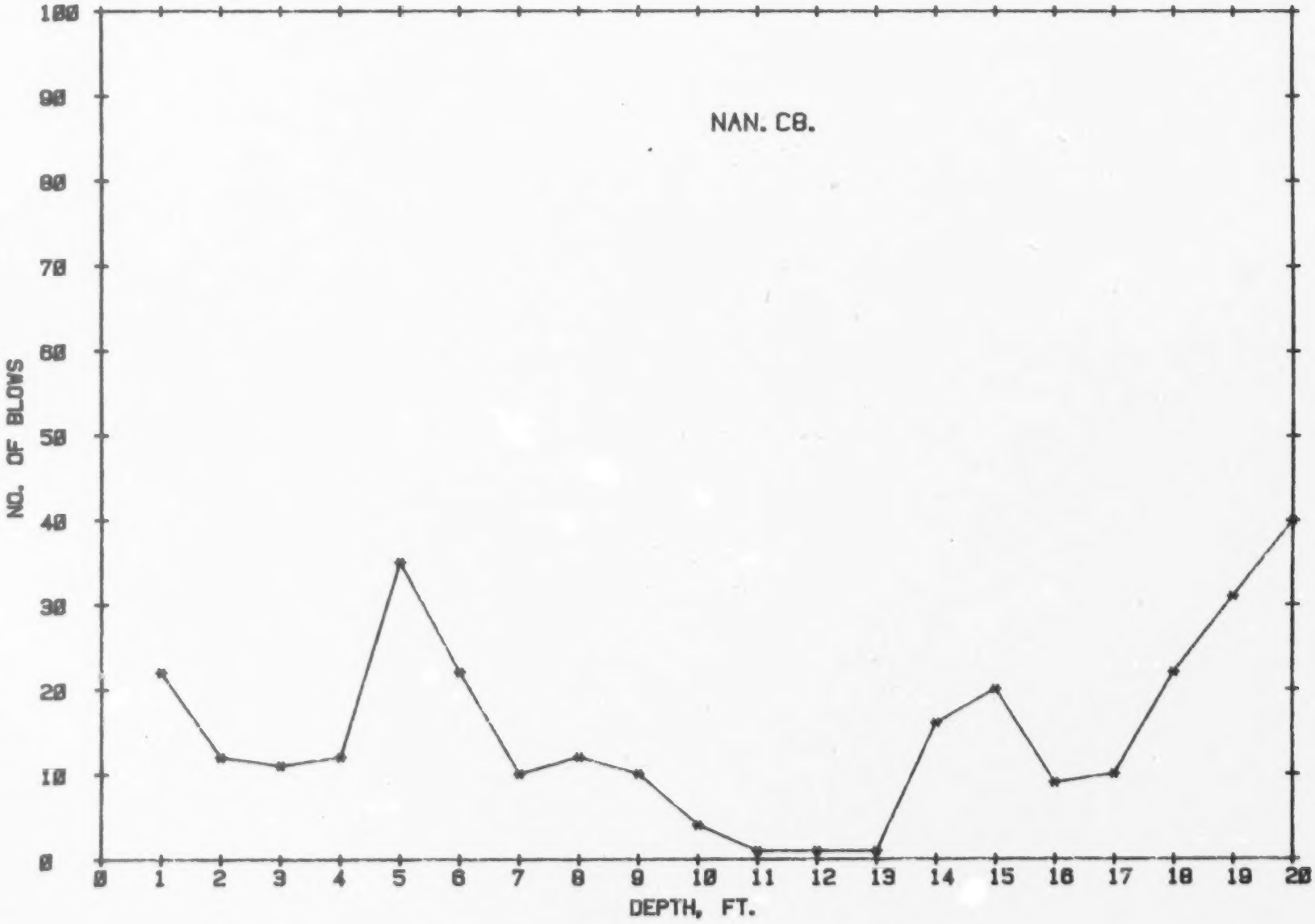
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. C8.
NO. OF BLOWS
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80
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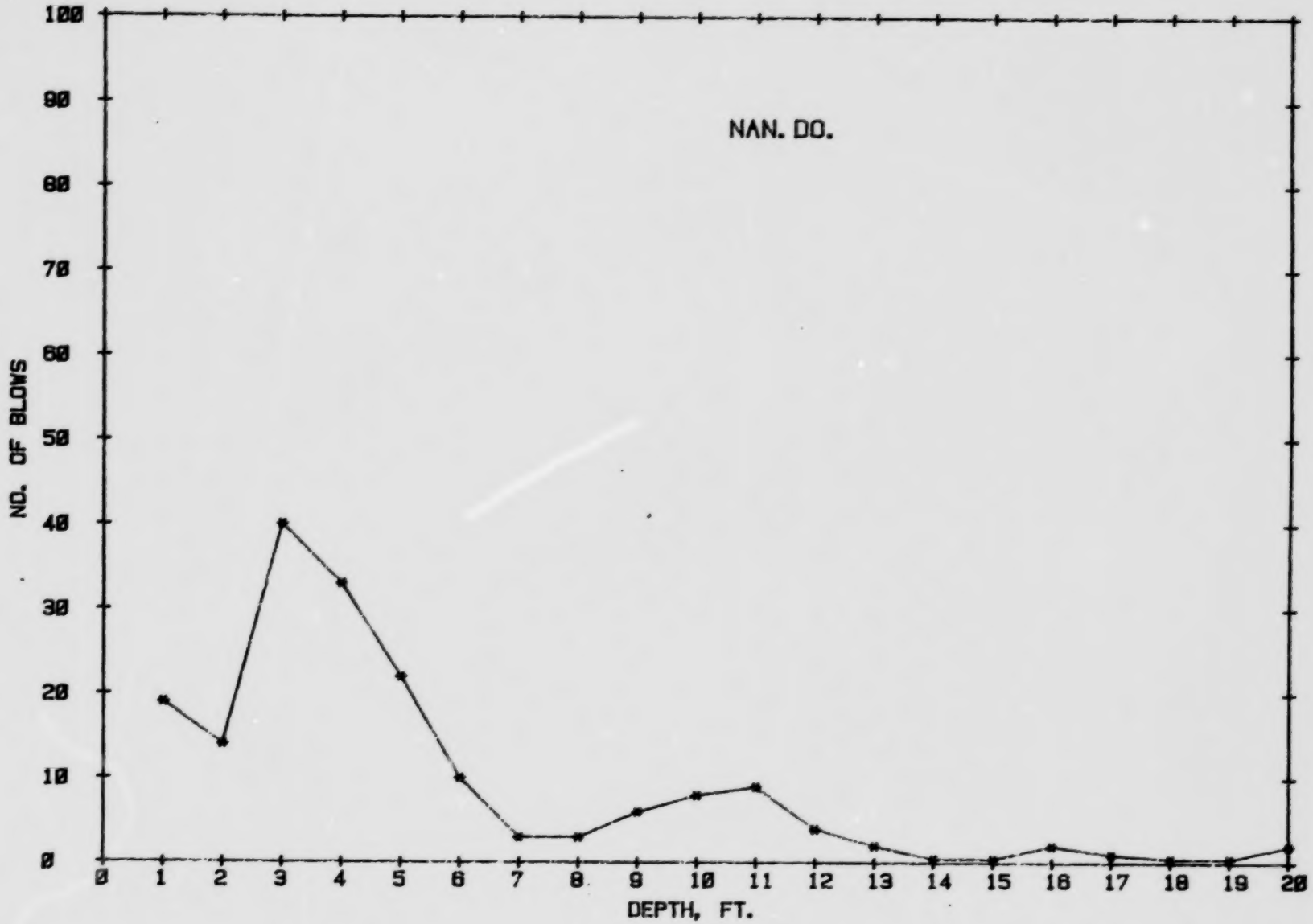
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. DO.
NO. OF BLOWS
100
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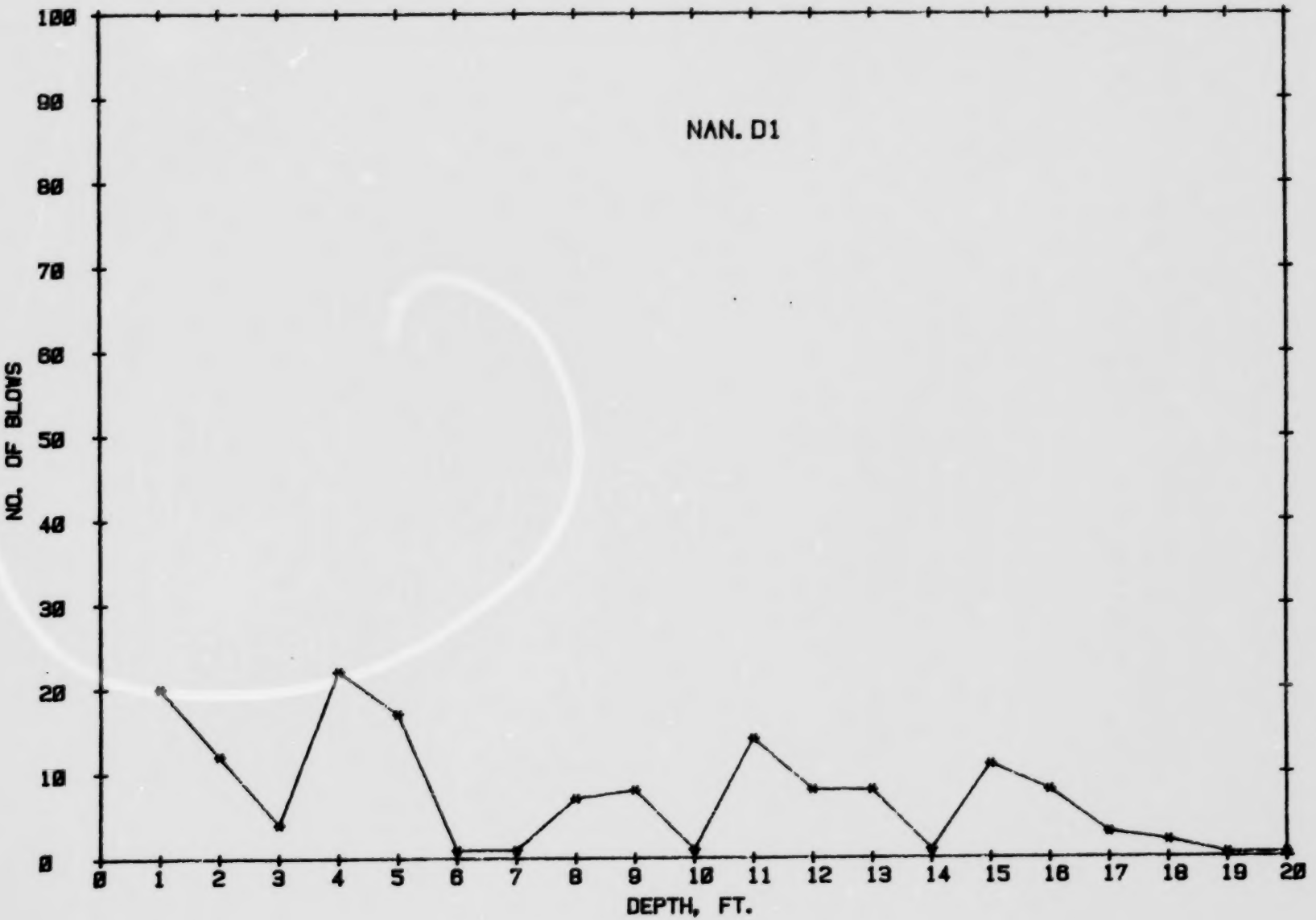
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. D1
NO. OF BLOWS
100
90
80
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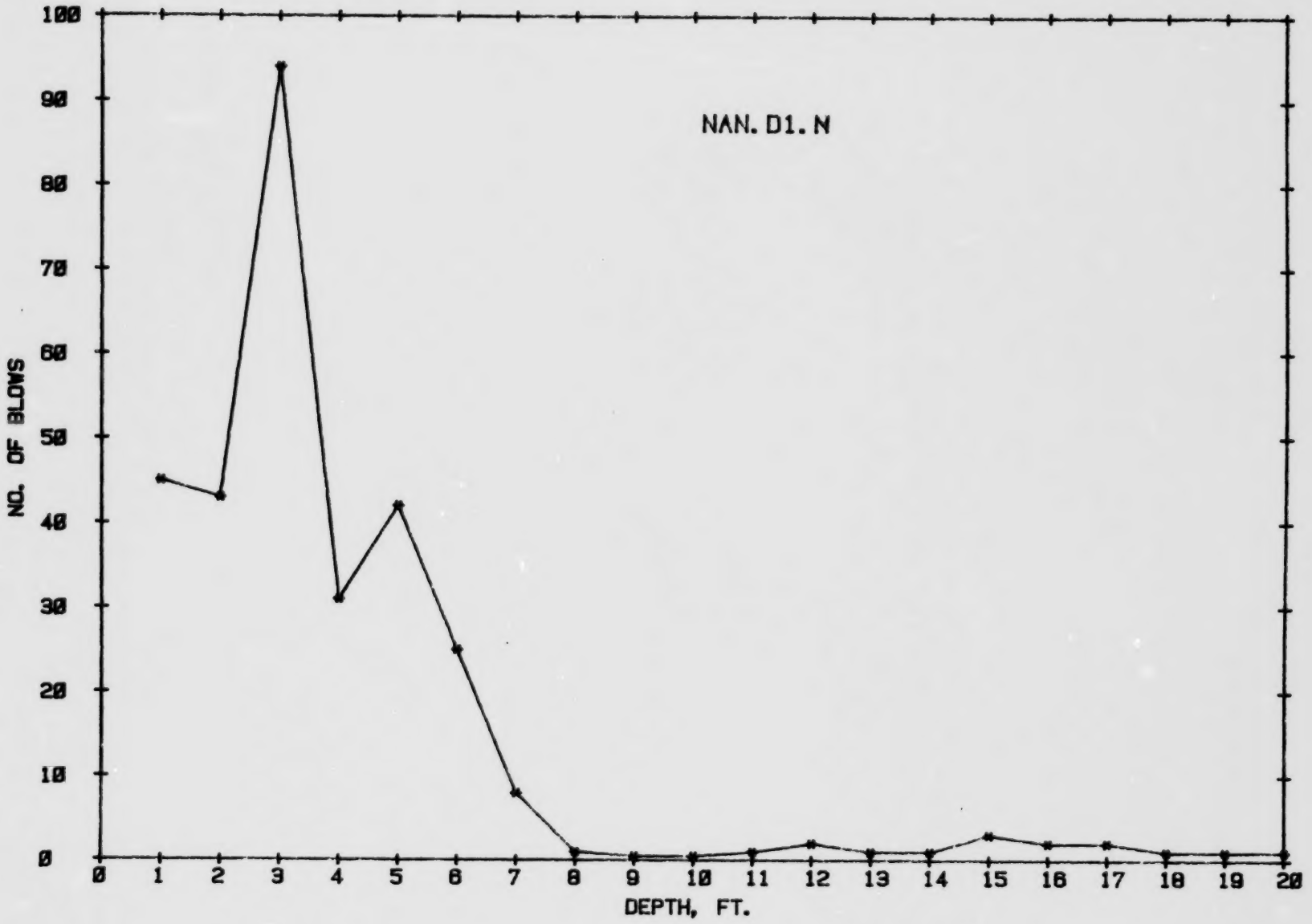
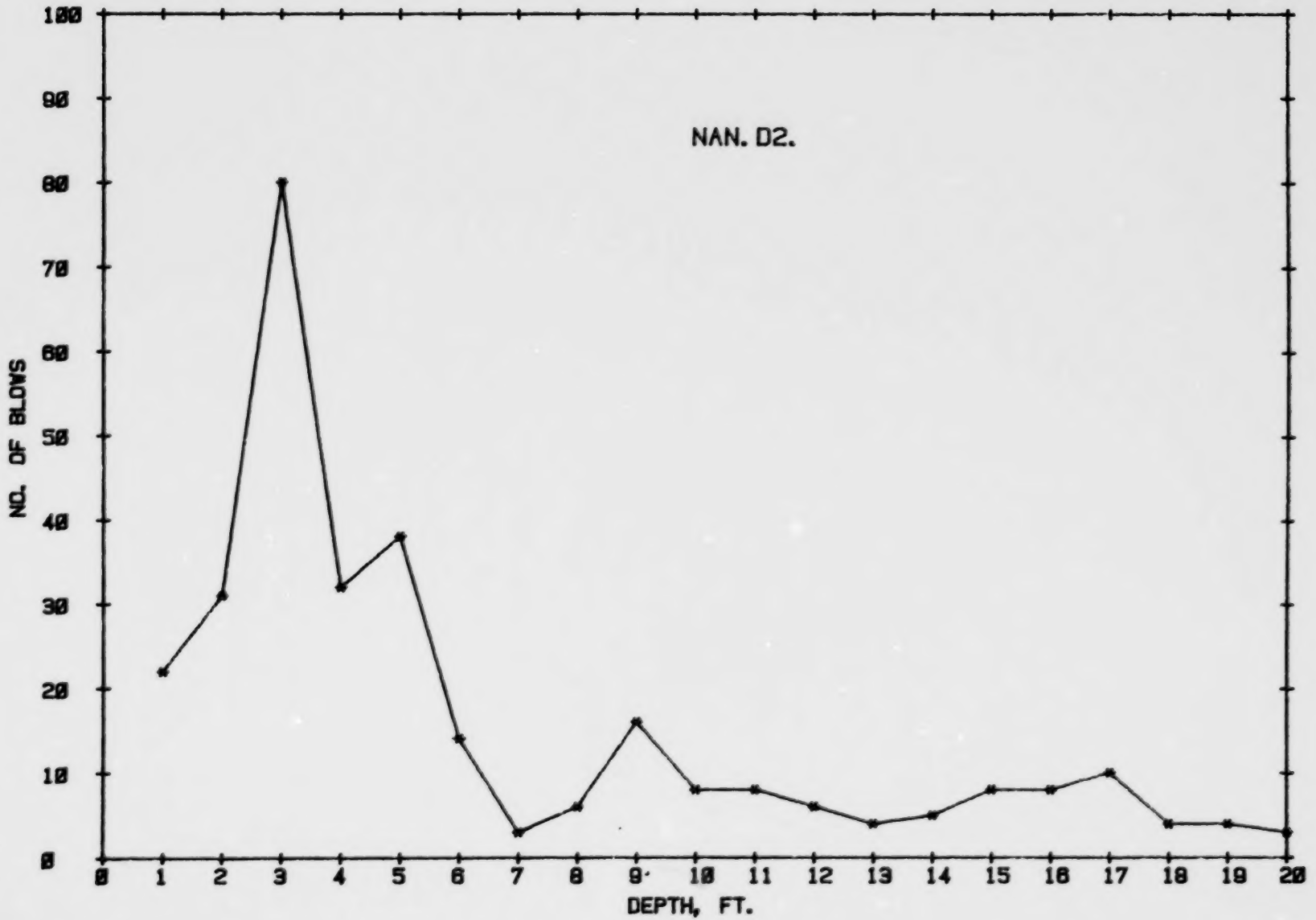
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. D1. N
NO. OF BLOWS
100
90
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. D2.
NO. OF BLOWS
100
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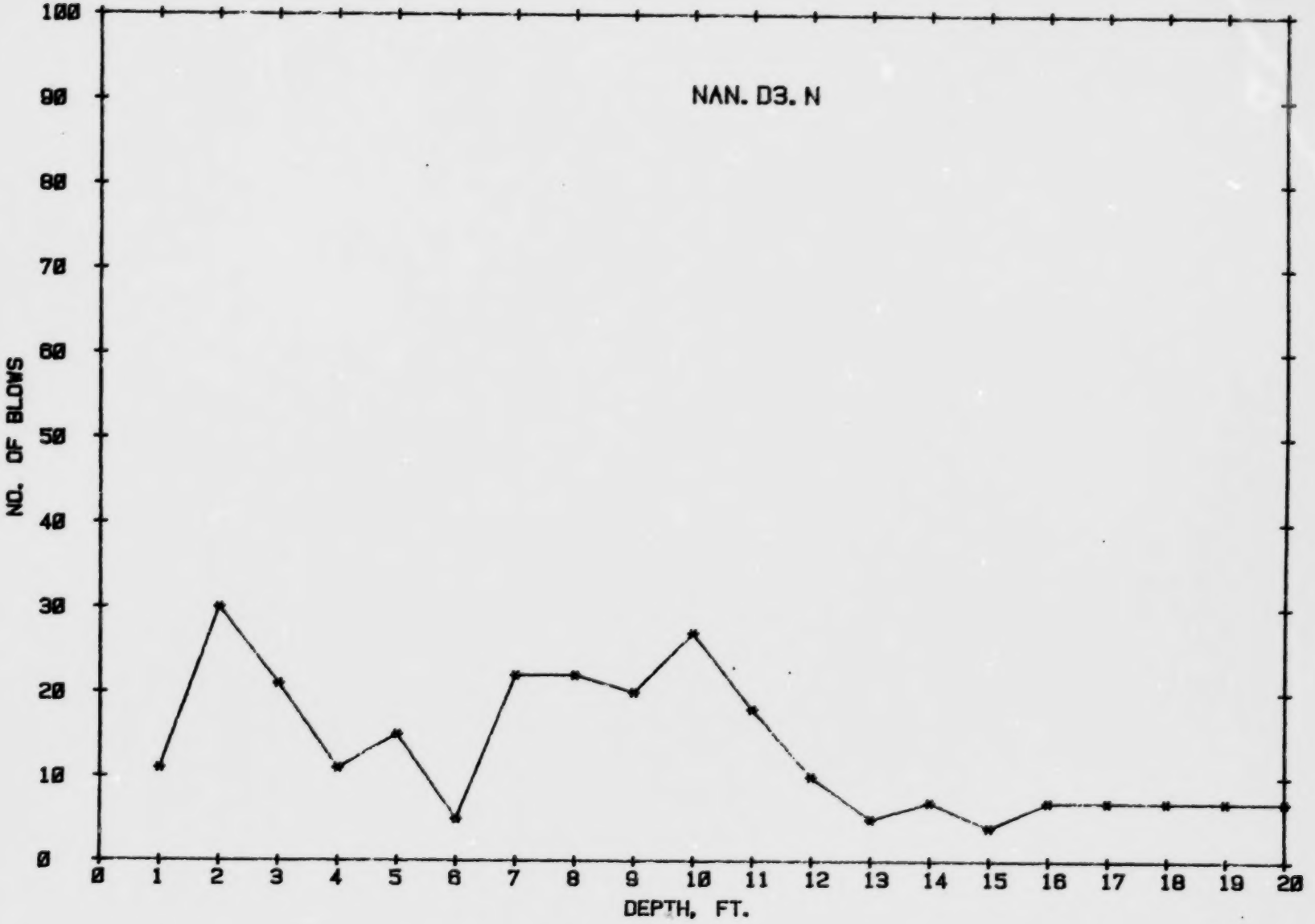
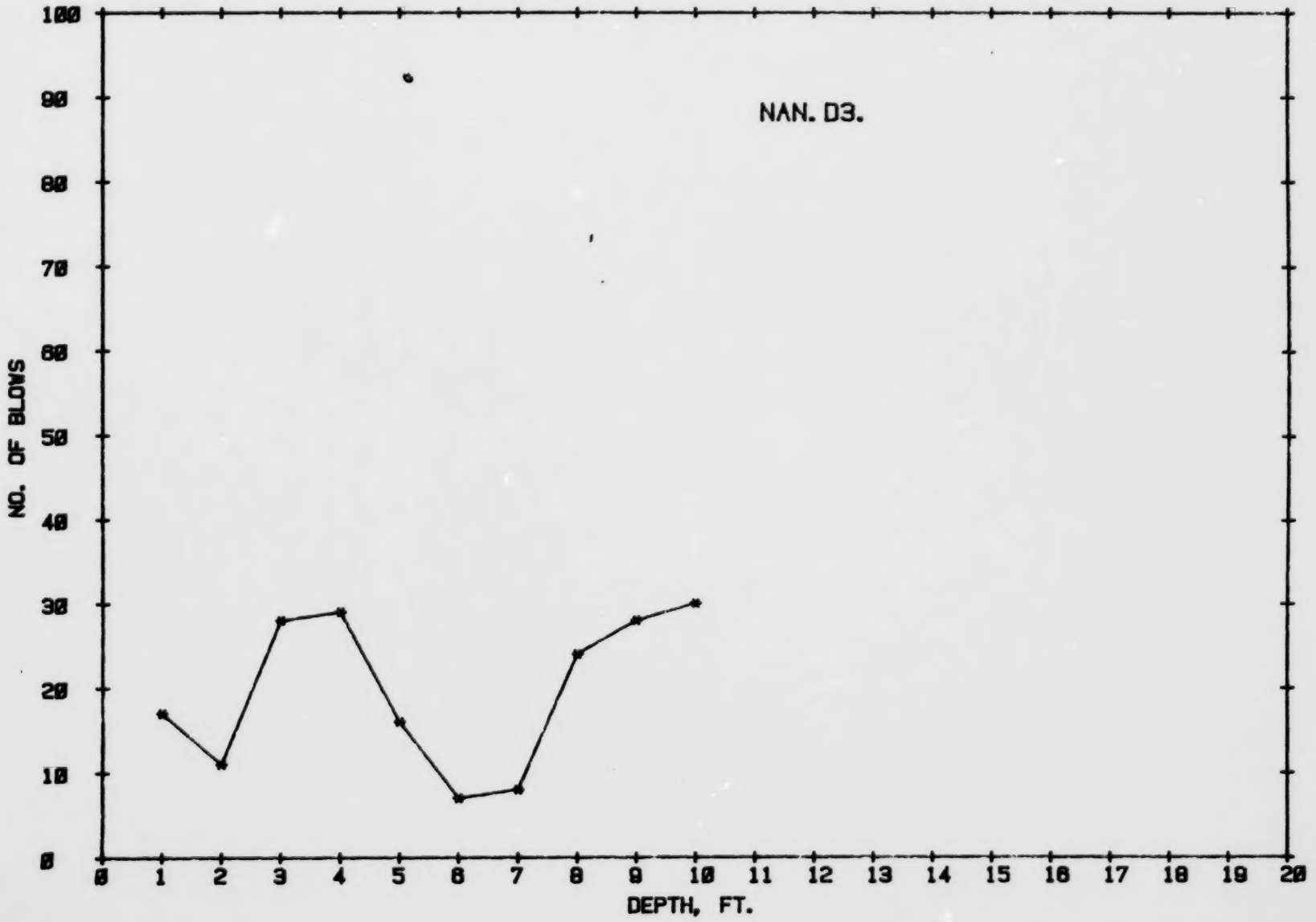
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. D3. N
NO. OF BLOWS
100
90
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. 03.
NO. OF BLOWS
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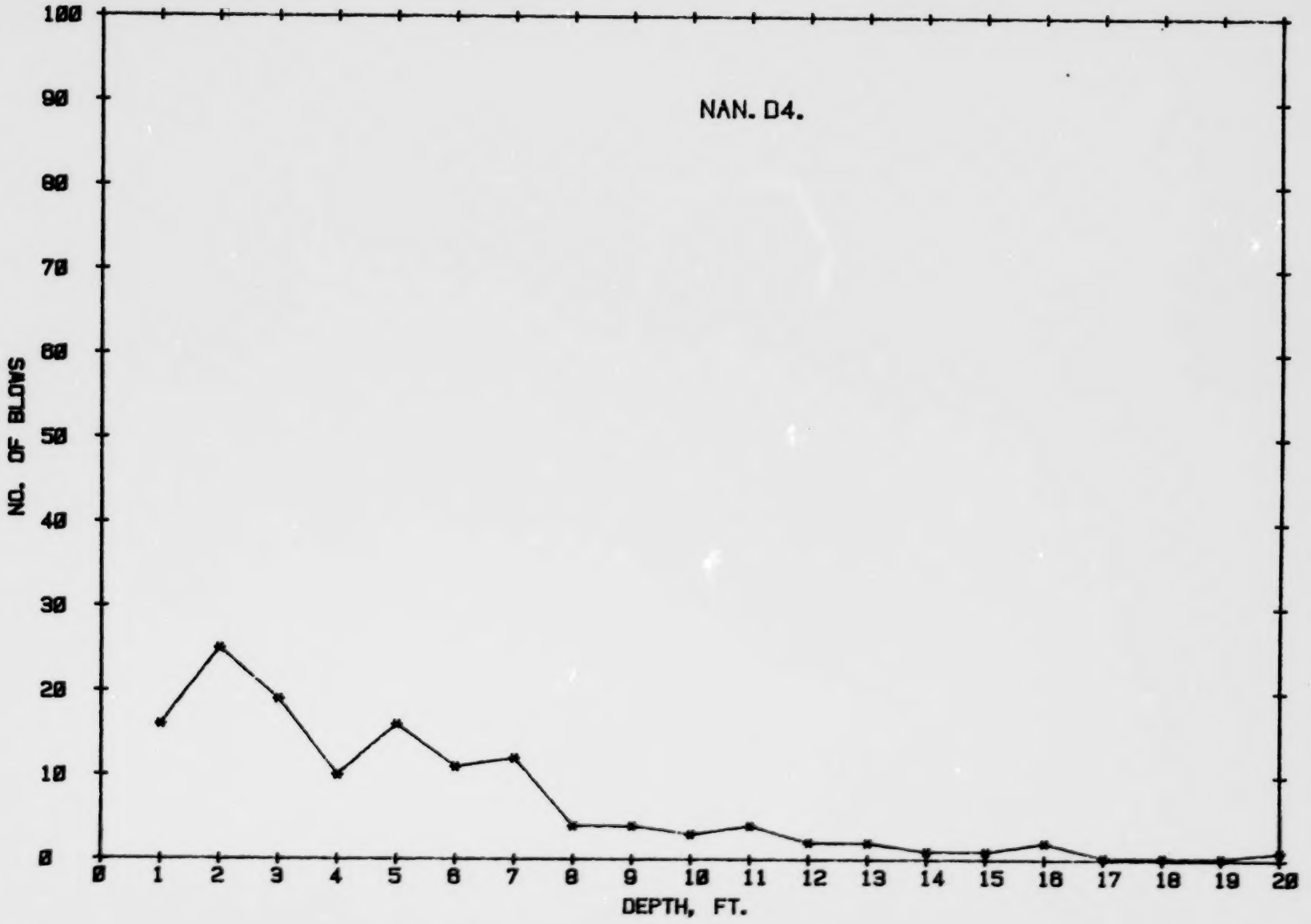
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. D4.
NO. OF BLOWS
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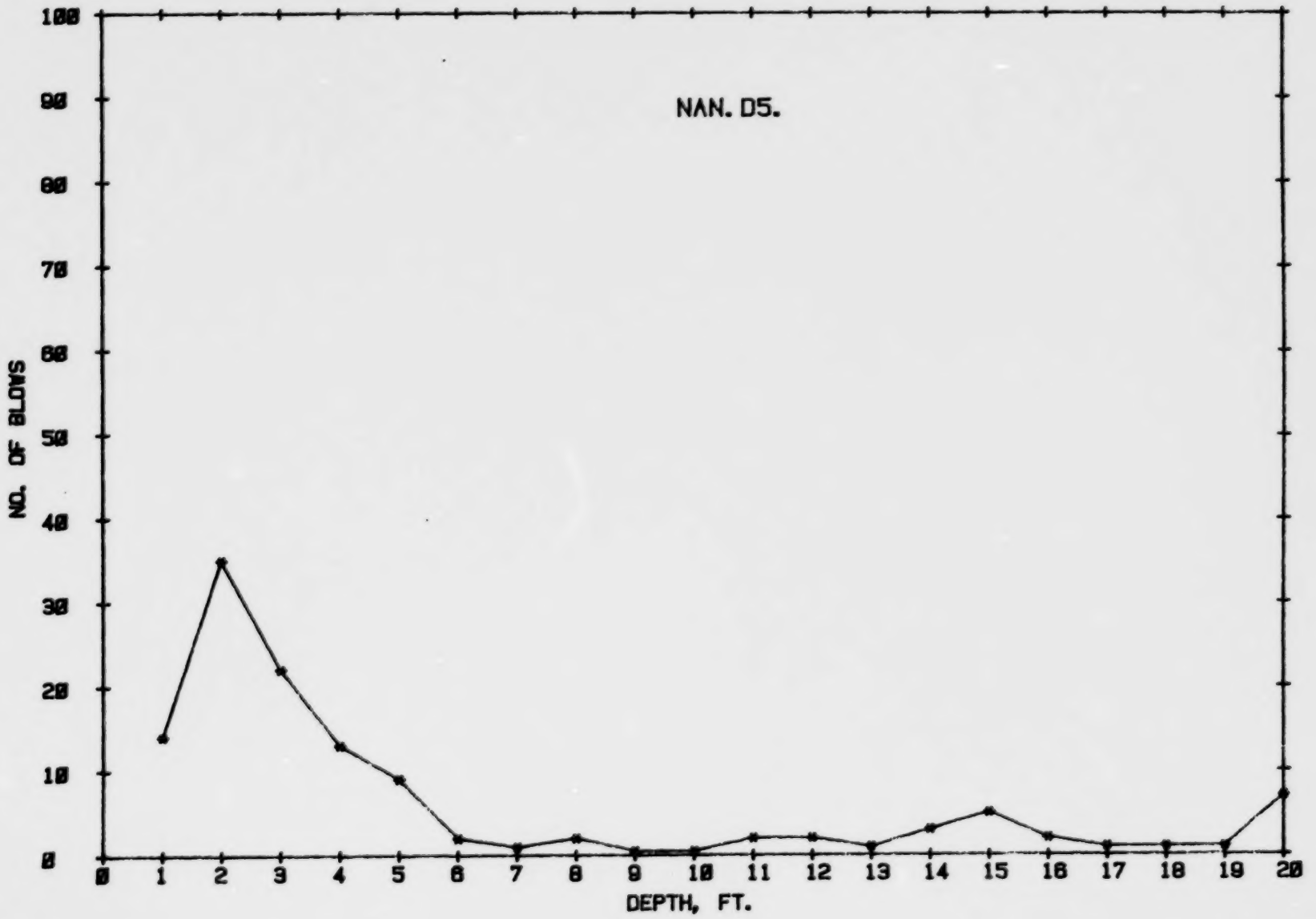
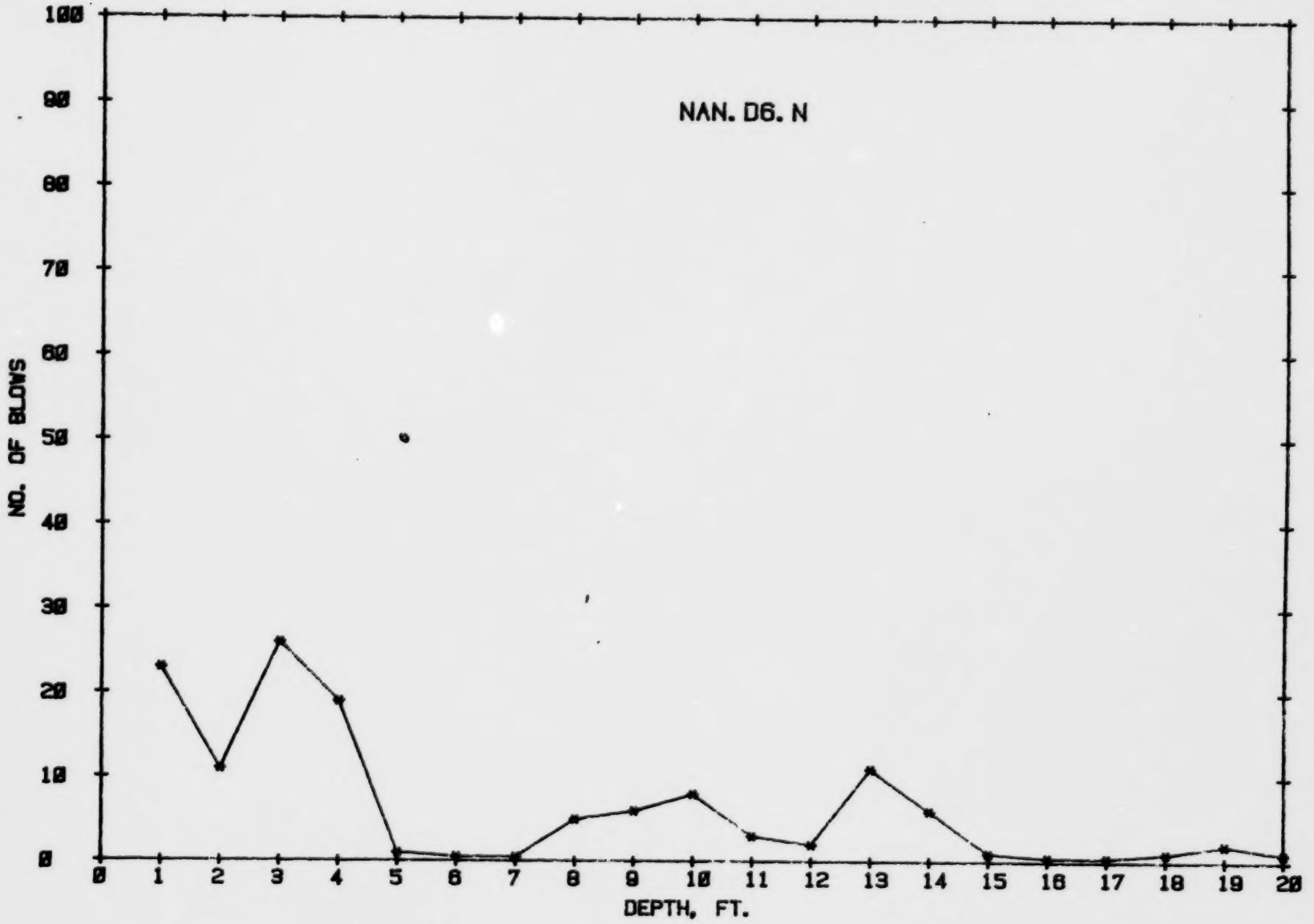
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. D5.
NO. OF BLOWS
100
90
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. D6. N
NO. OF BLOWS
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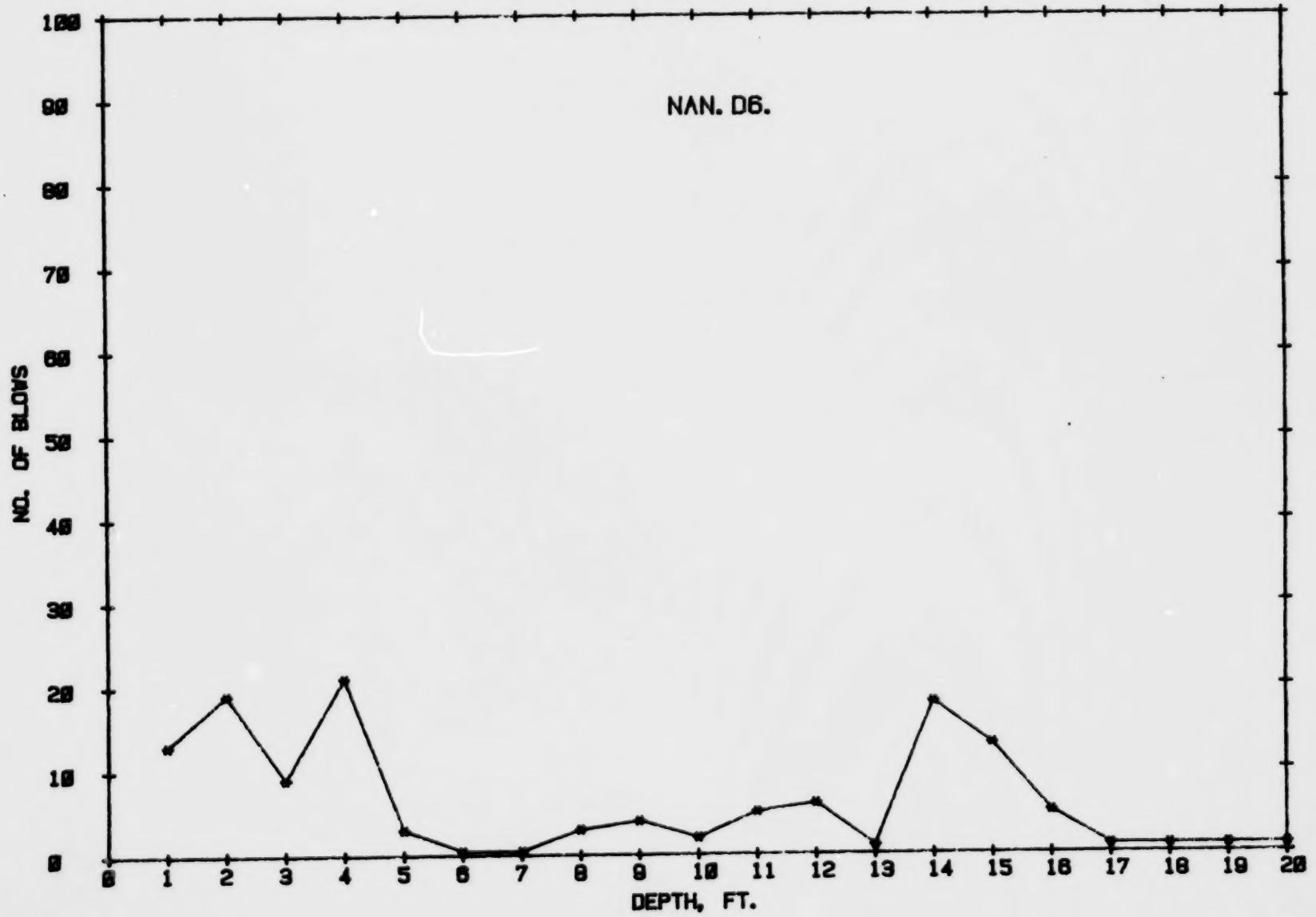
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. D6.
NO. OF BLOWS
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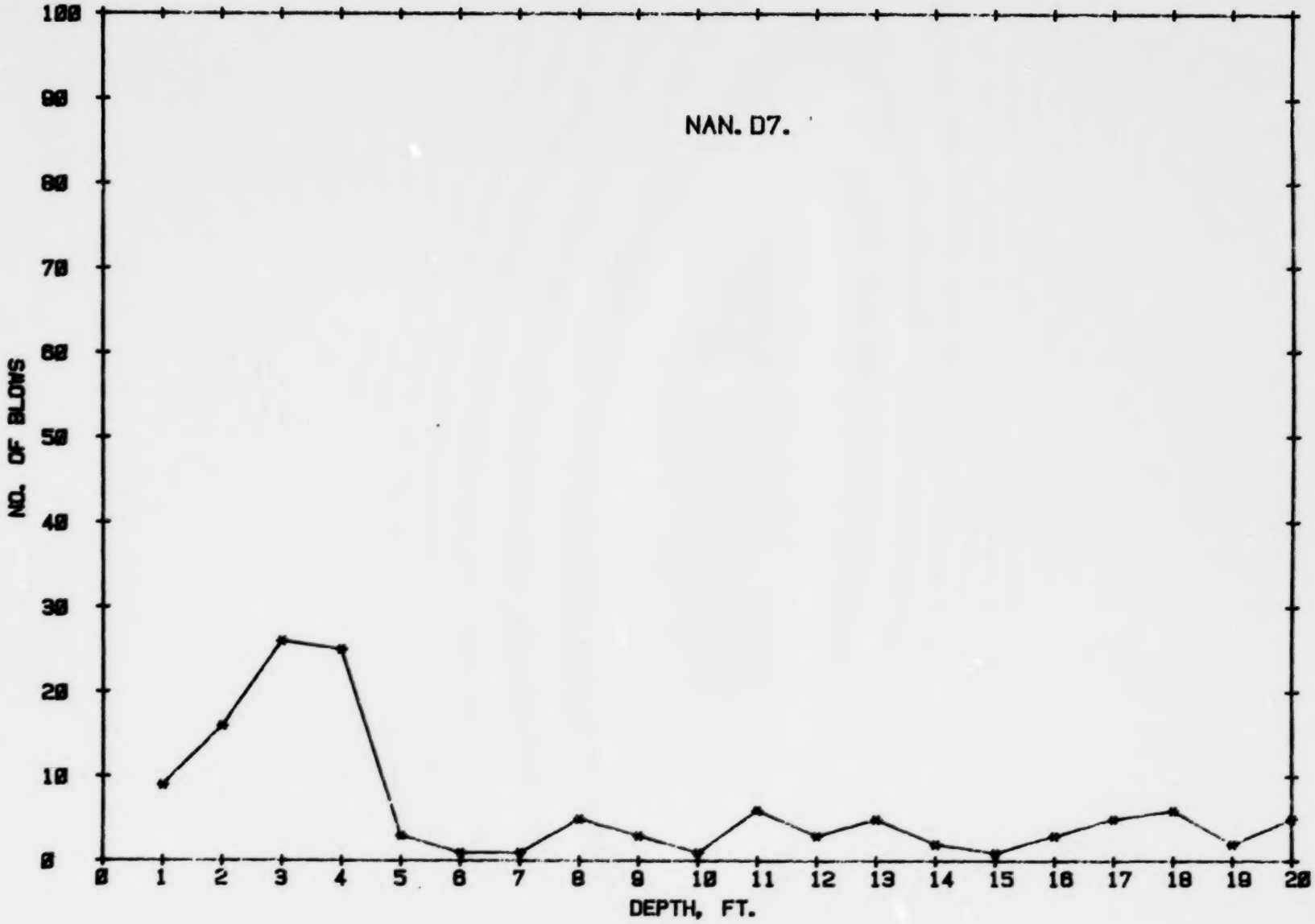
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. D7.
NO. OF BLOWS
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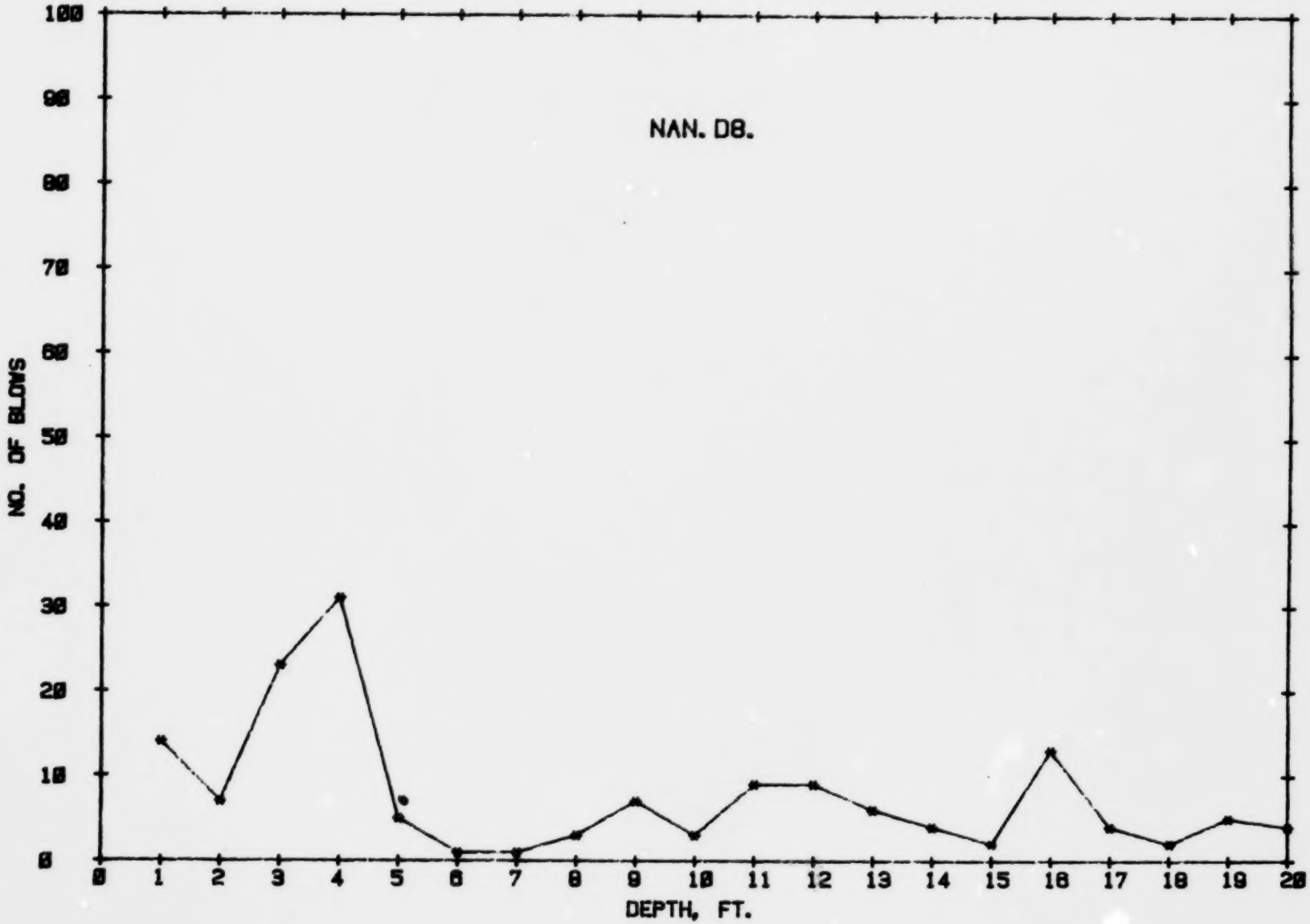
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. D8.
NO. OF BLOWS
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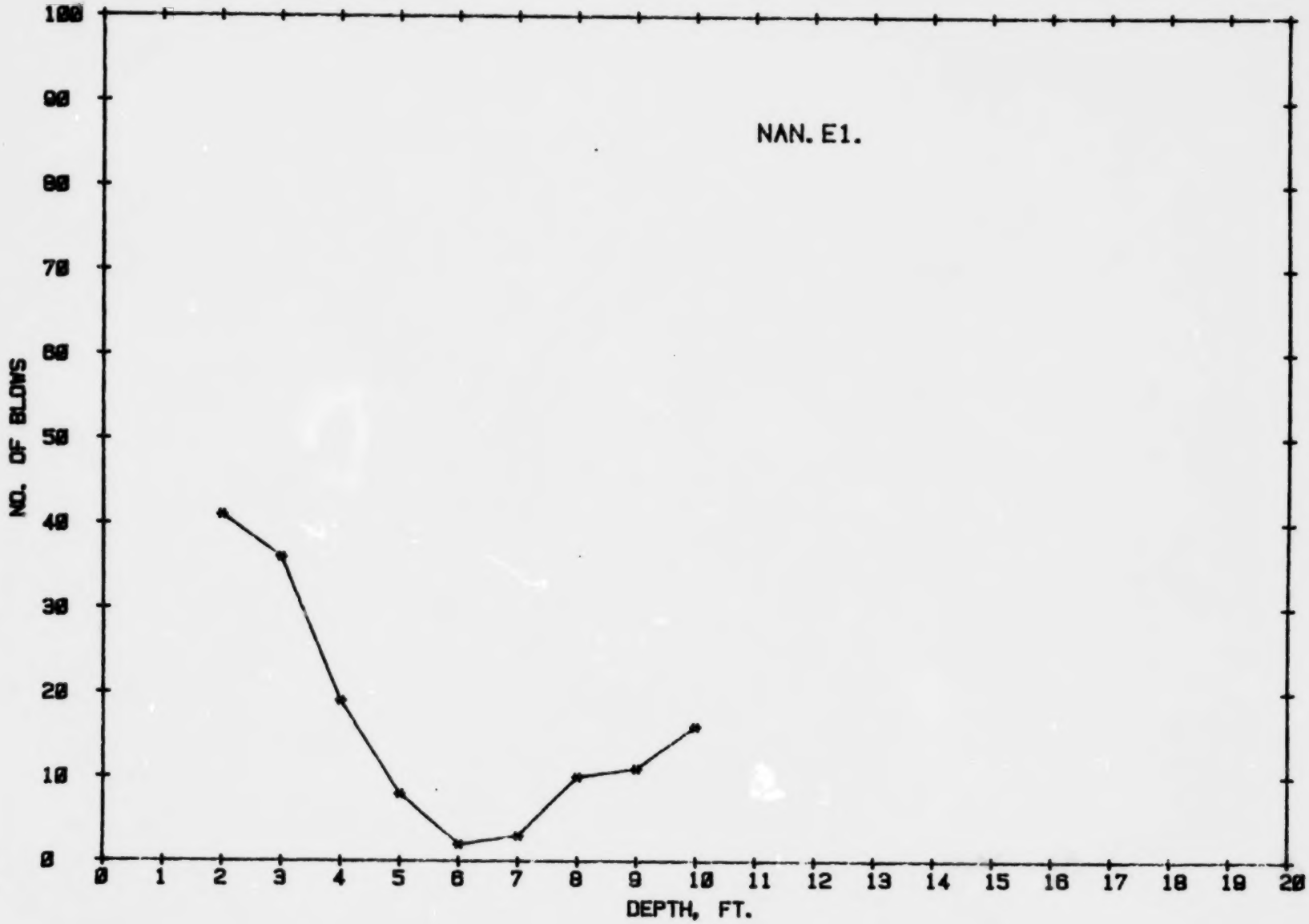
DEPTH, FT.


NAN. E1.
NO. OF BLOWS
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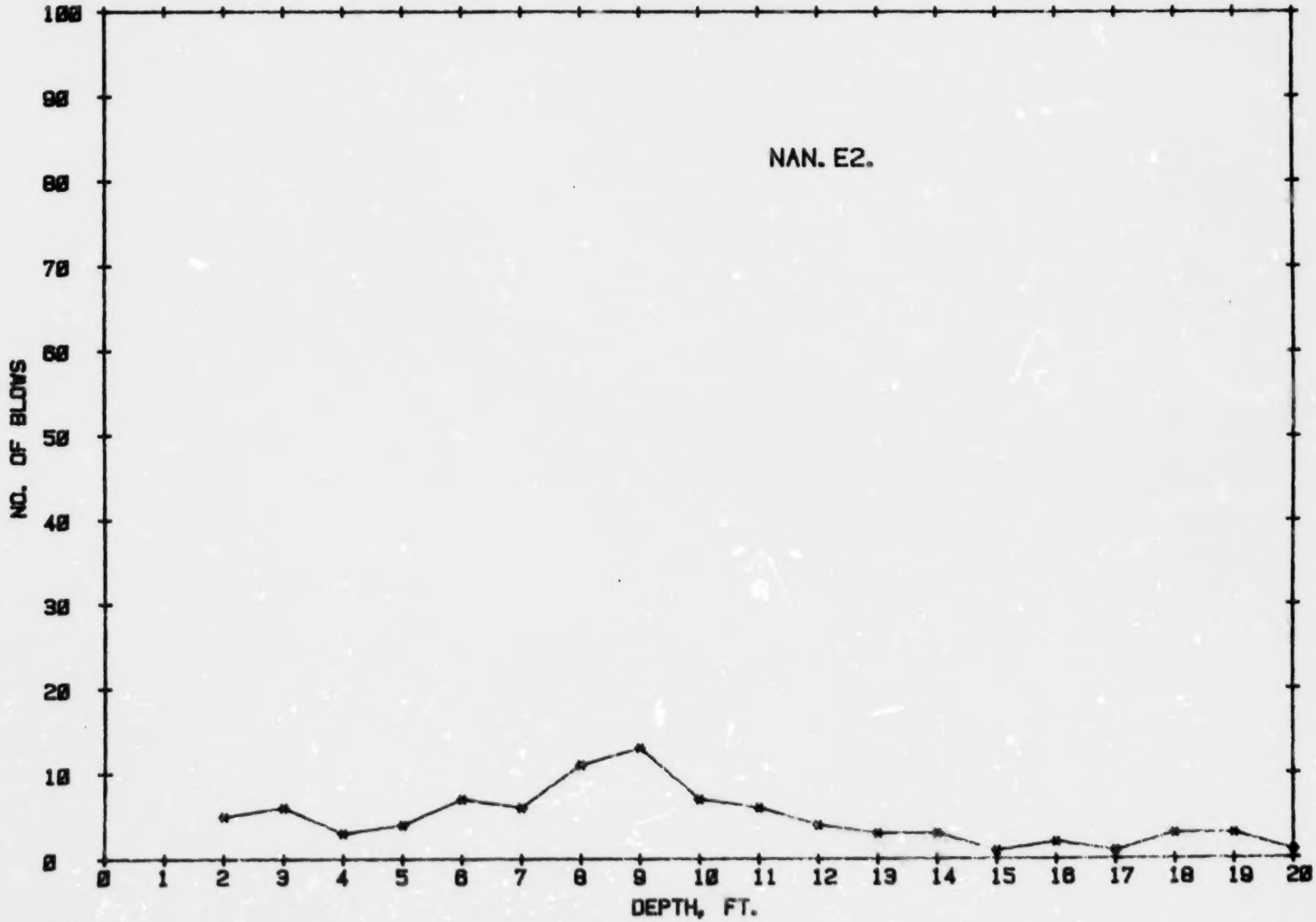
DEPTH, FT.


NAN. E2.
NO. OF BLOWS
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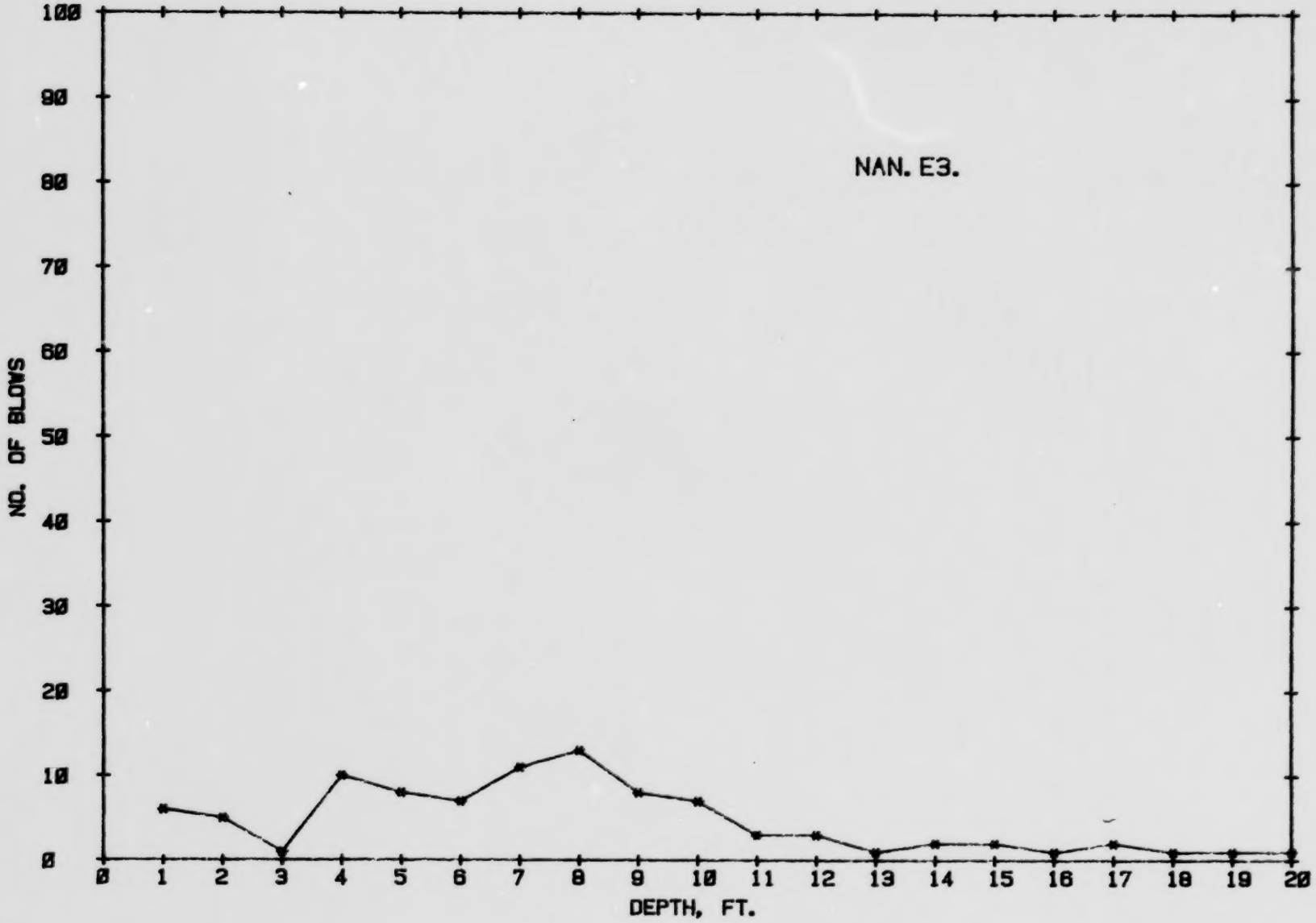
DEPTH, FT.


NAN. E3.
NO. OF BLOWS
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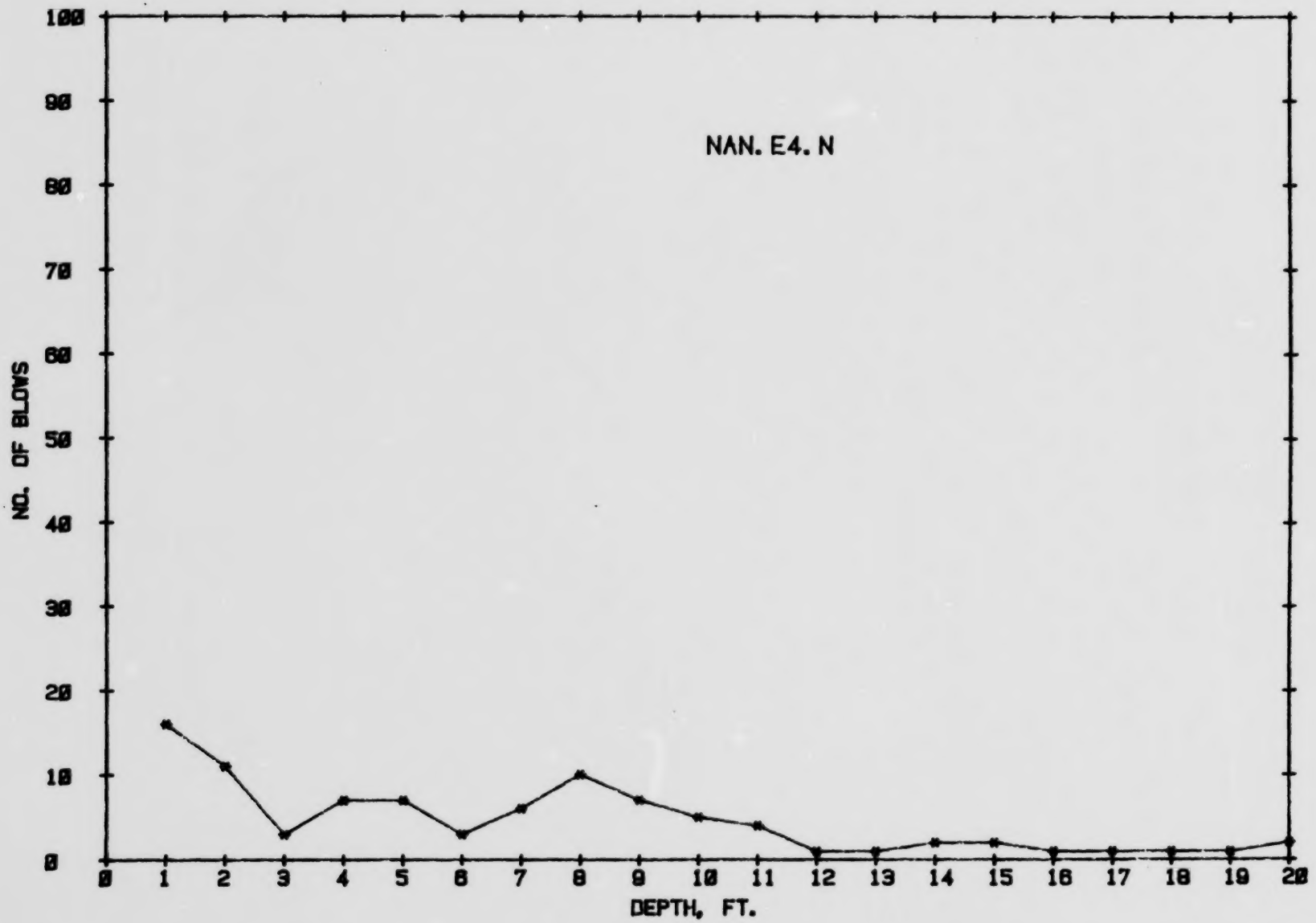
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. E4. N
NO. OF BLOWS
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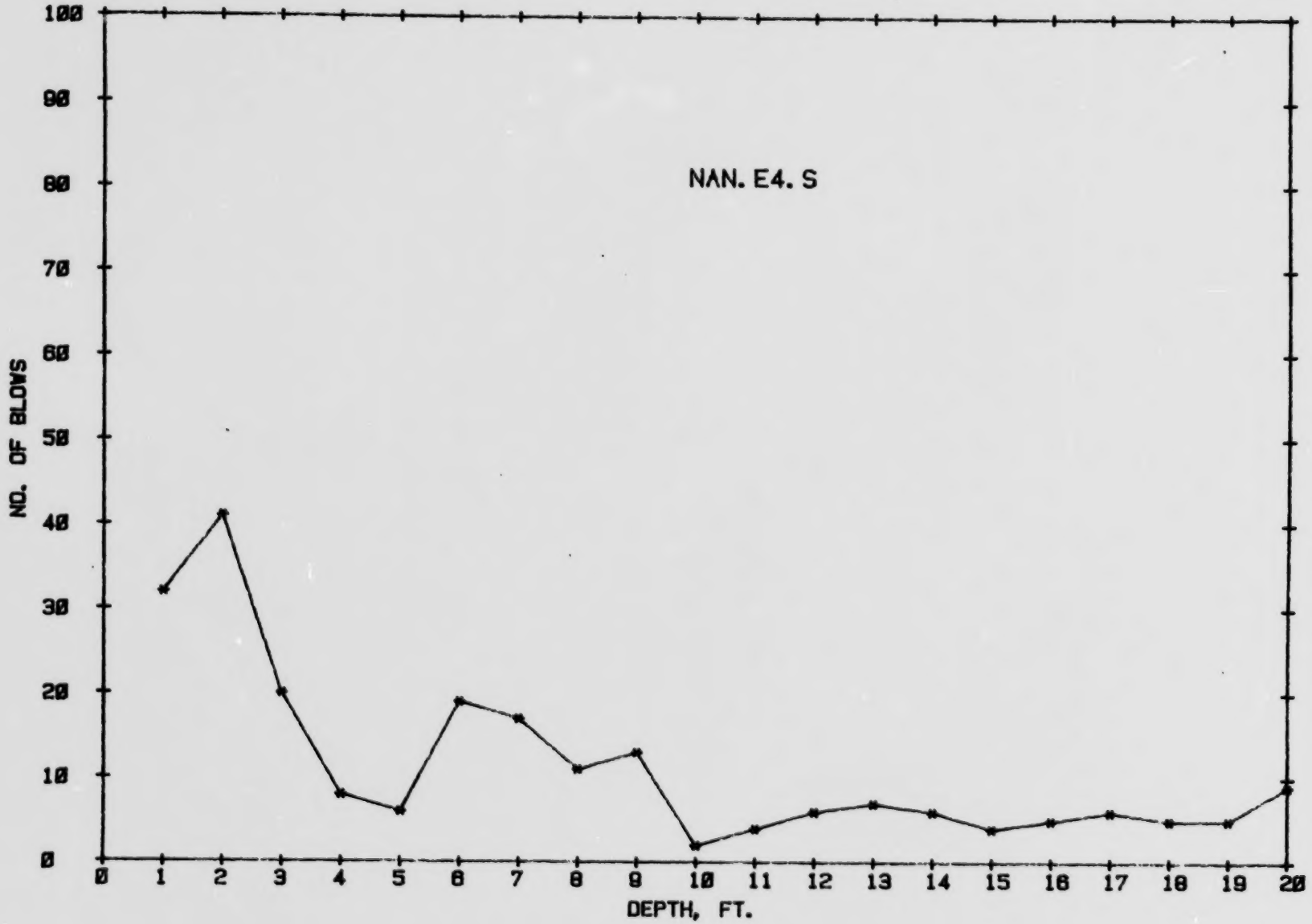
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. E4. S
NO. OF BLOWS
DEPTH, FT.
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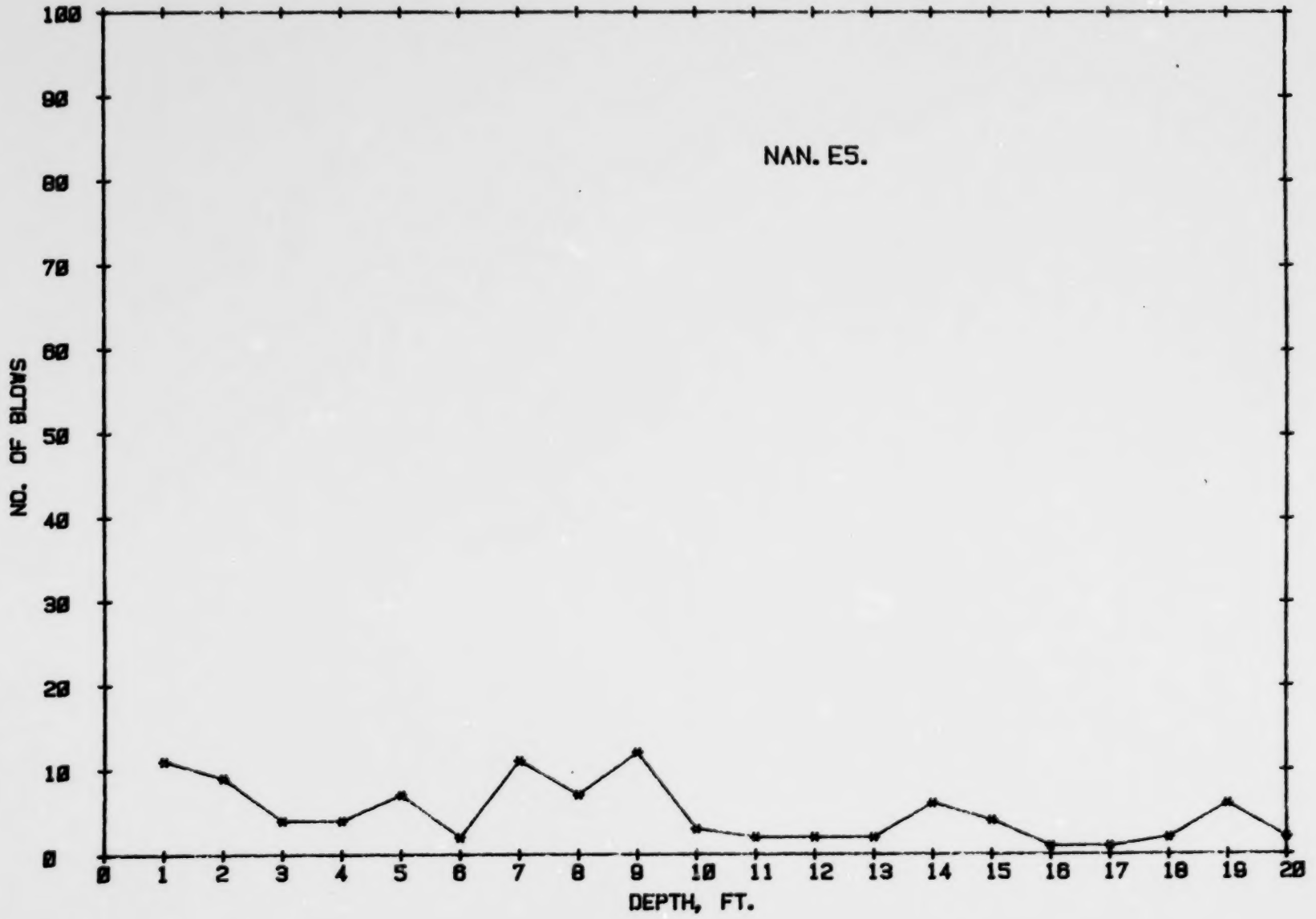
NAN. E5.
NO. OF BLOWS
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40
30
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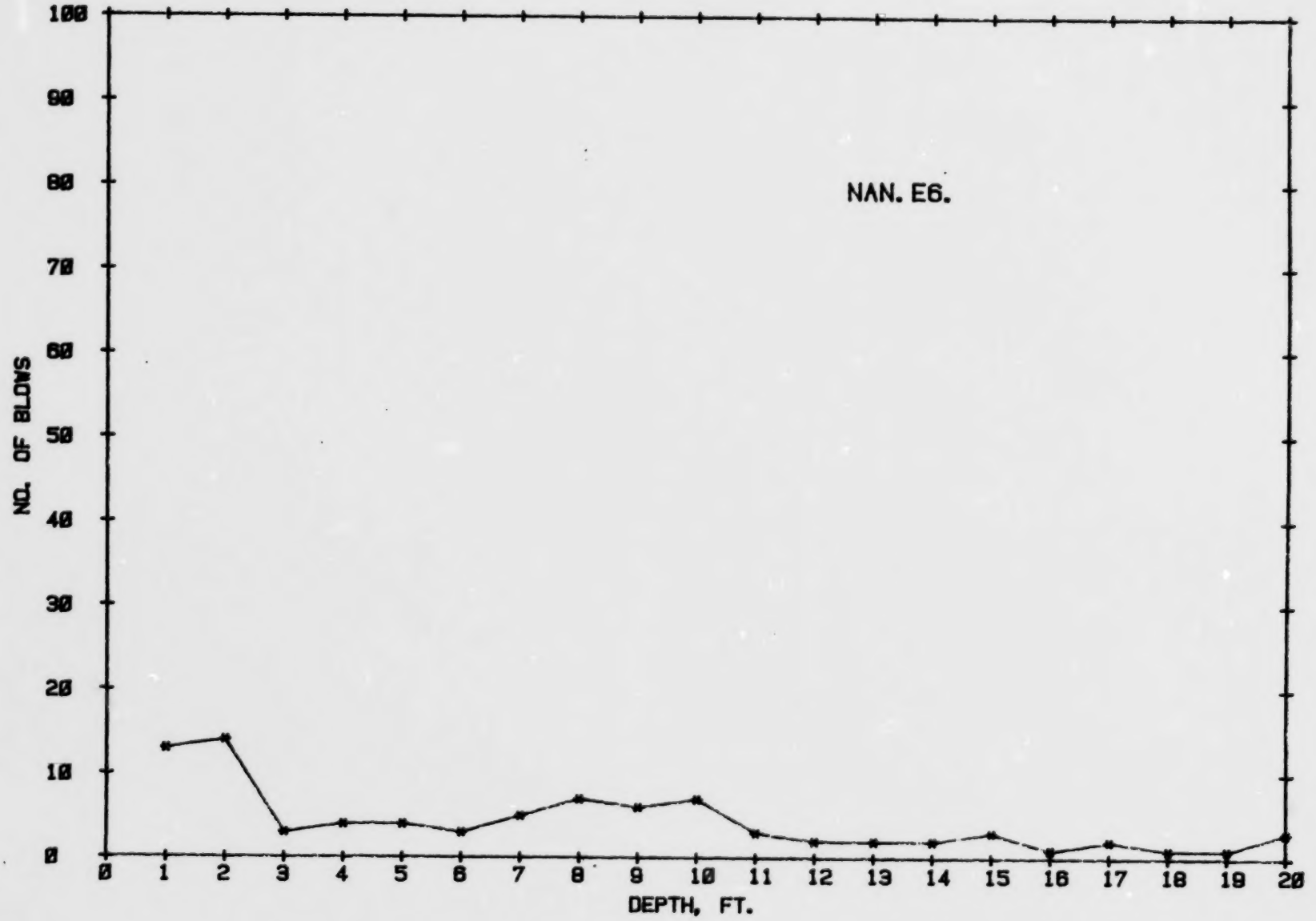
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. E6.
NO. OF BLOWS
100
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60
50
40
30
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10
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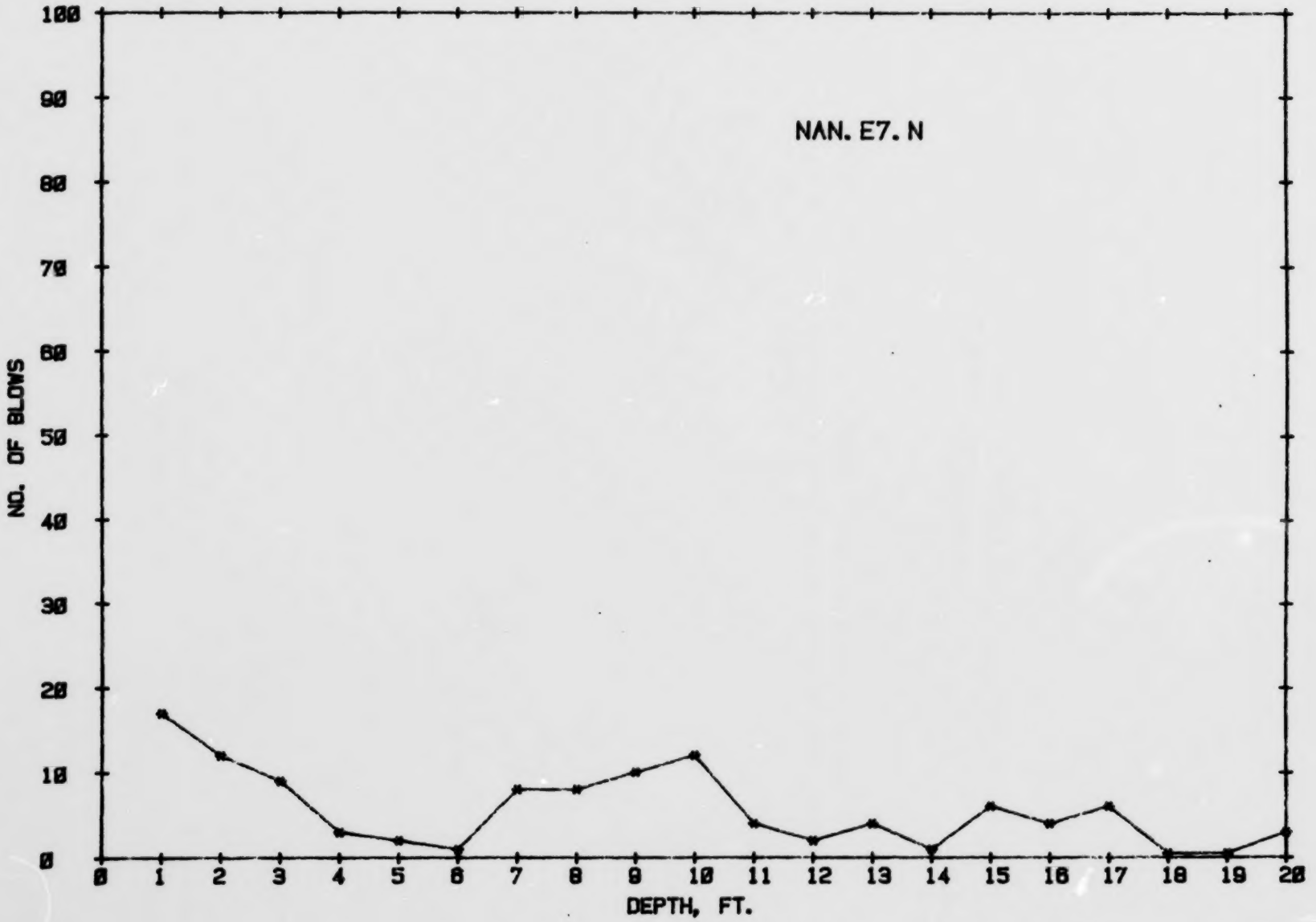
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. E7. N
NO. OF BLOWS
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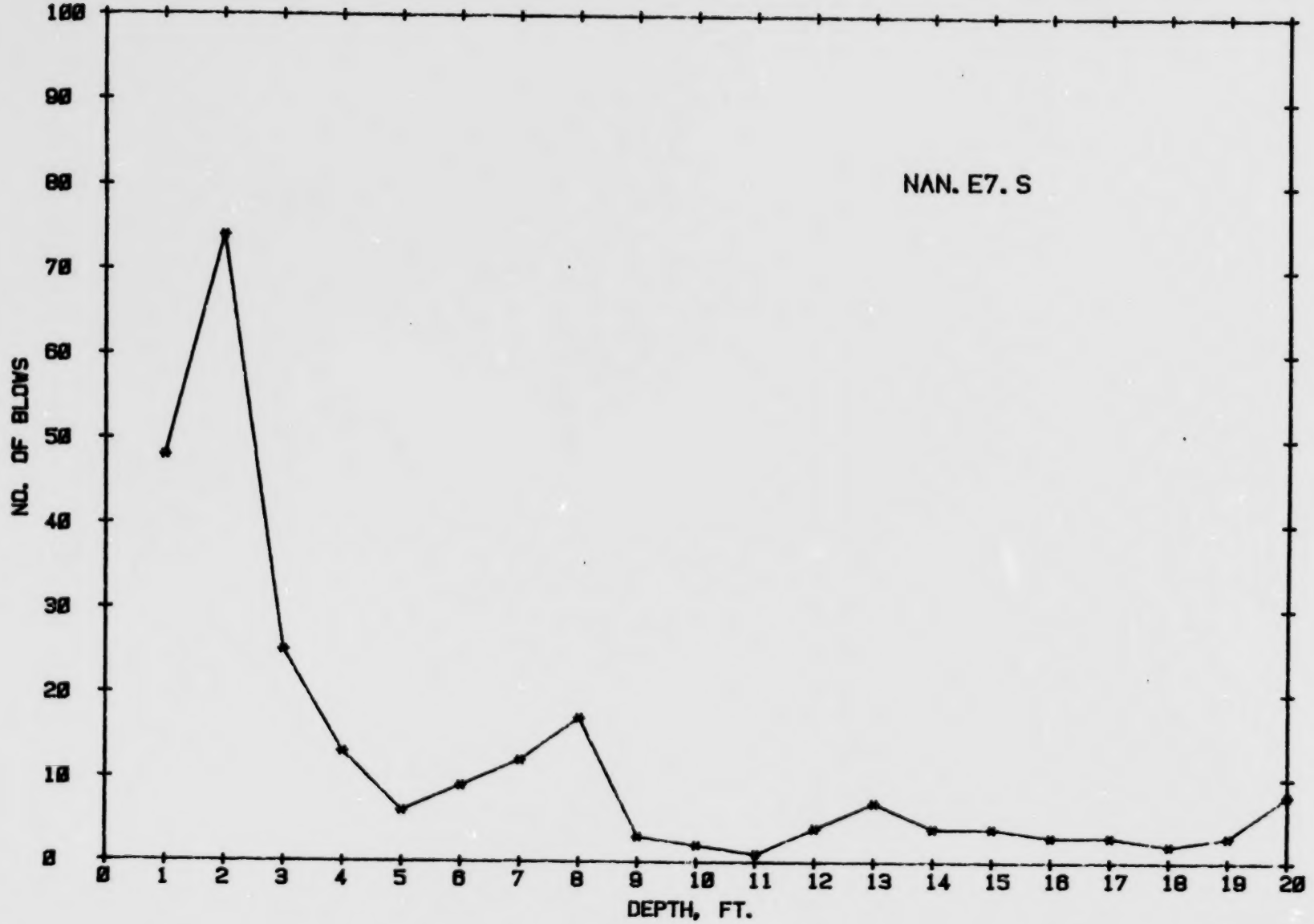
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. E7. S
NO. OF BLOWS
DEPTH, FT.
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60
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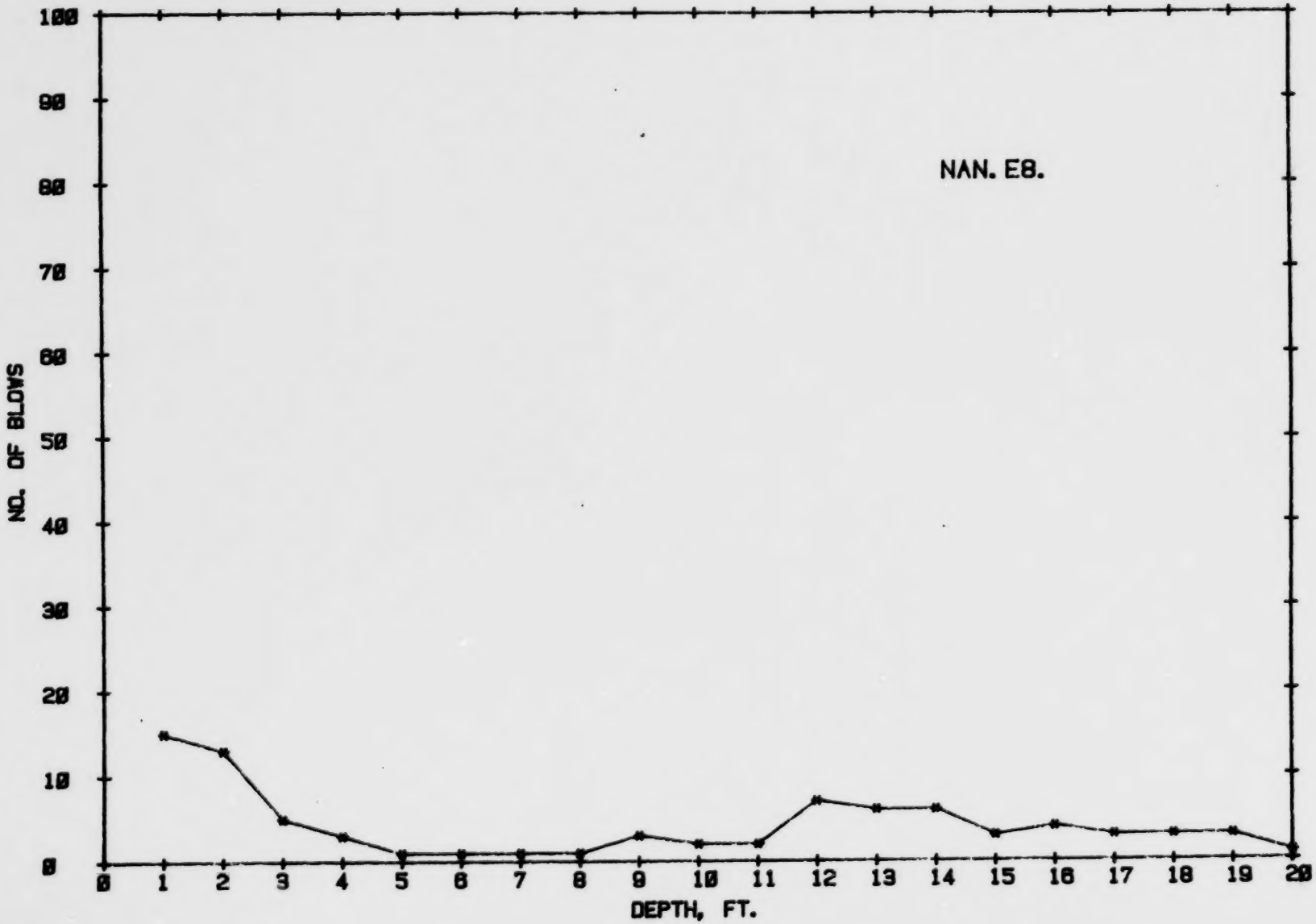
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20


NAN. E8.
NO. OF BLOWS
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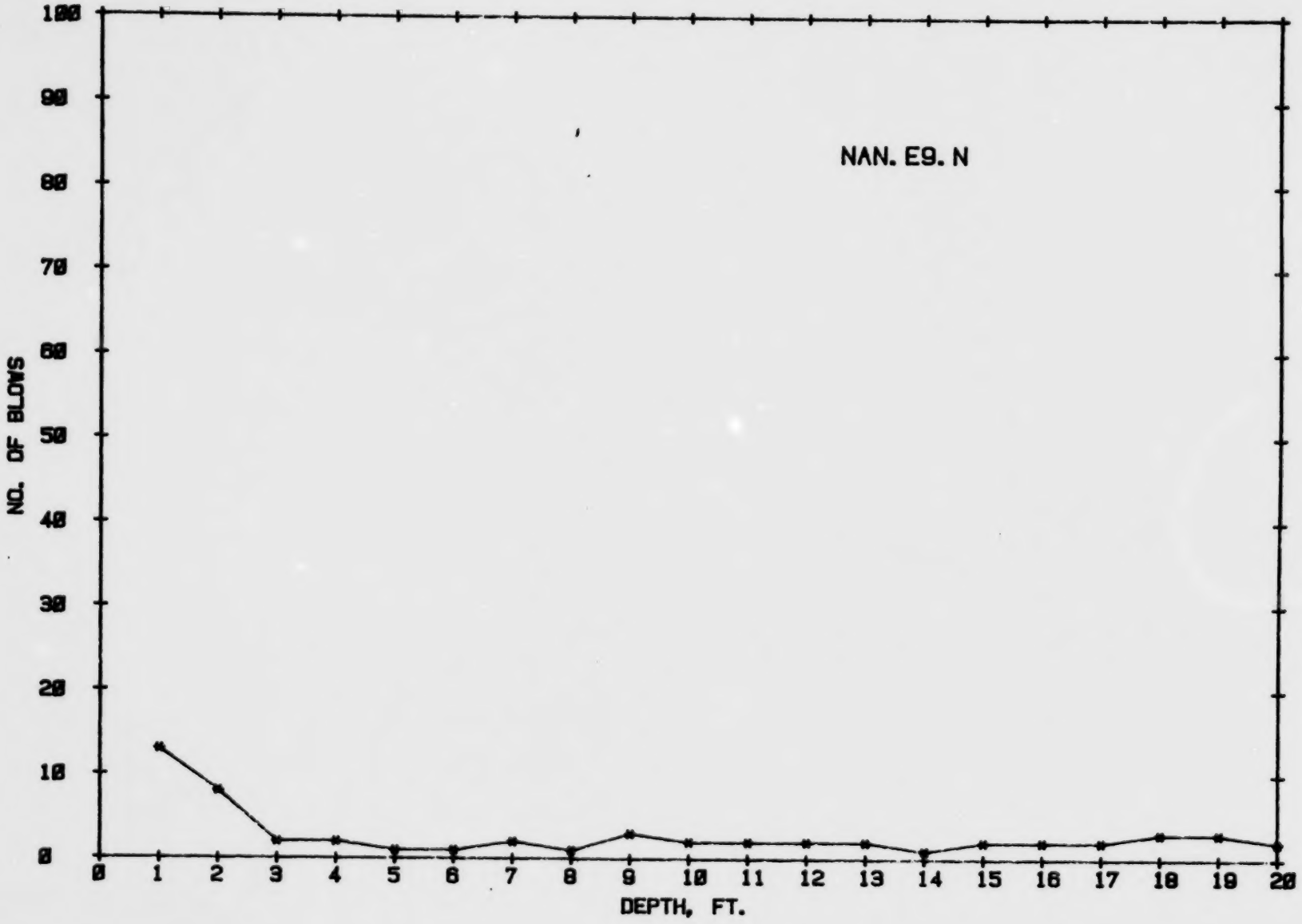
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. E9. N
NO. OF BLOWS
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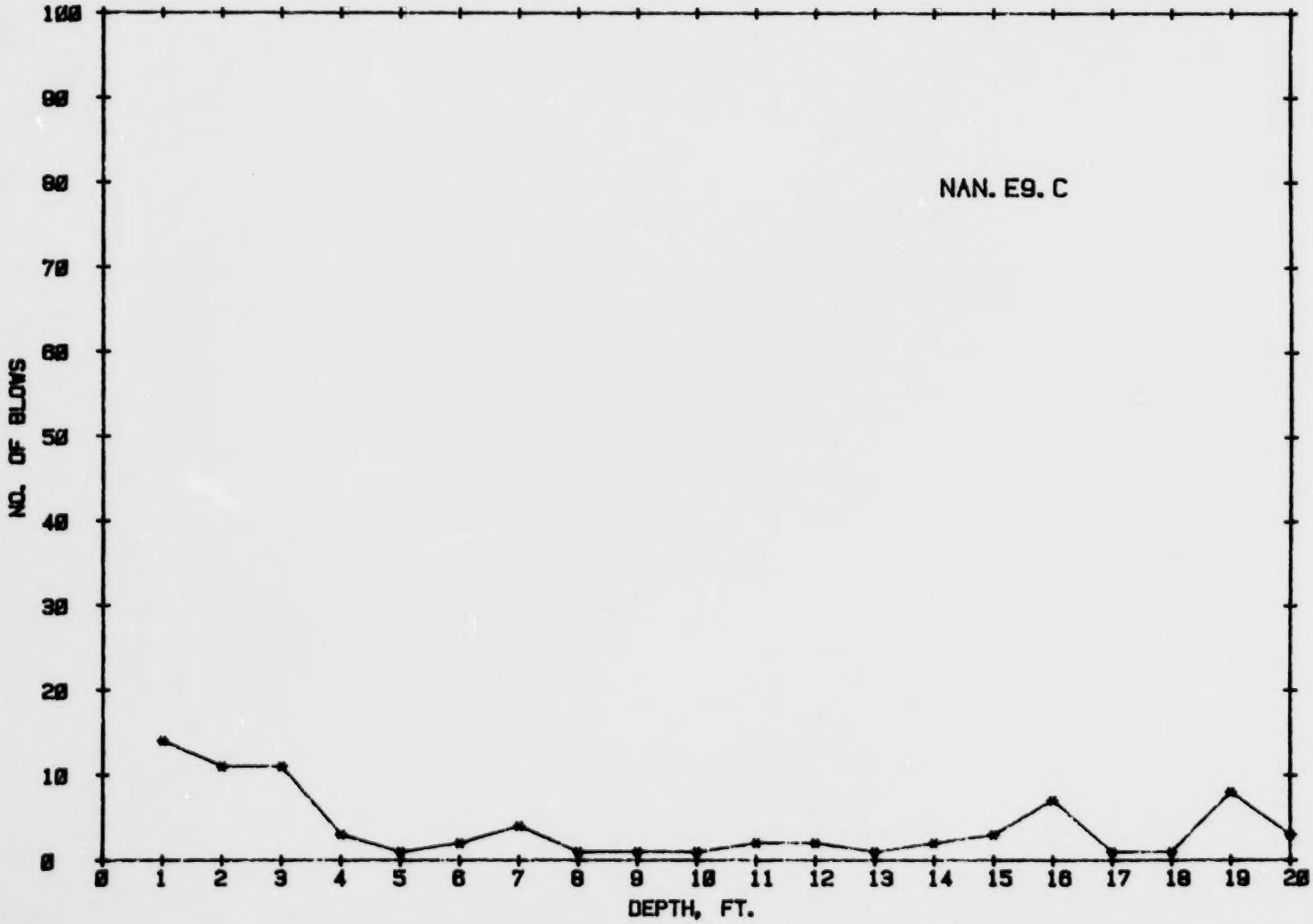
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. E9. C
NO. OF BLOWS
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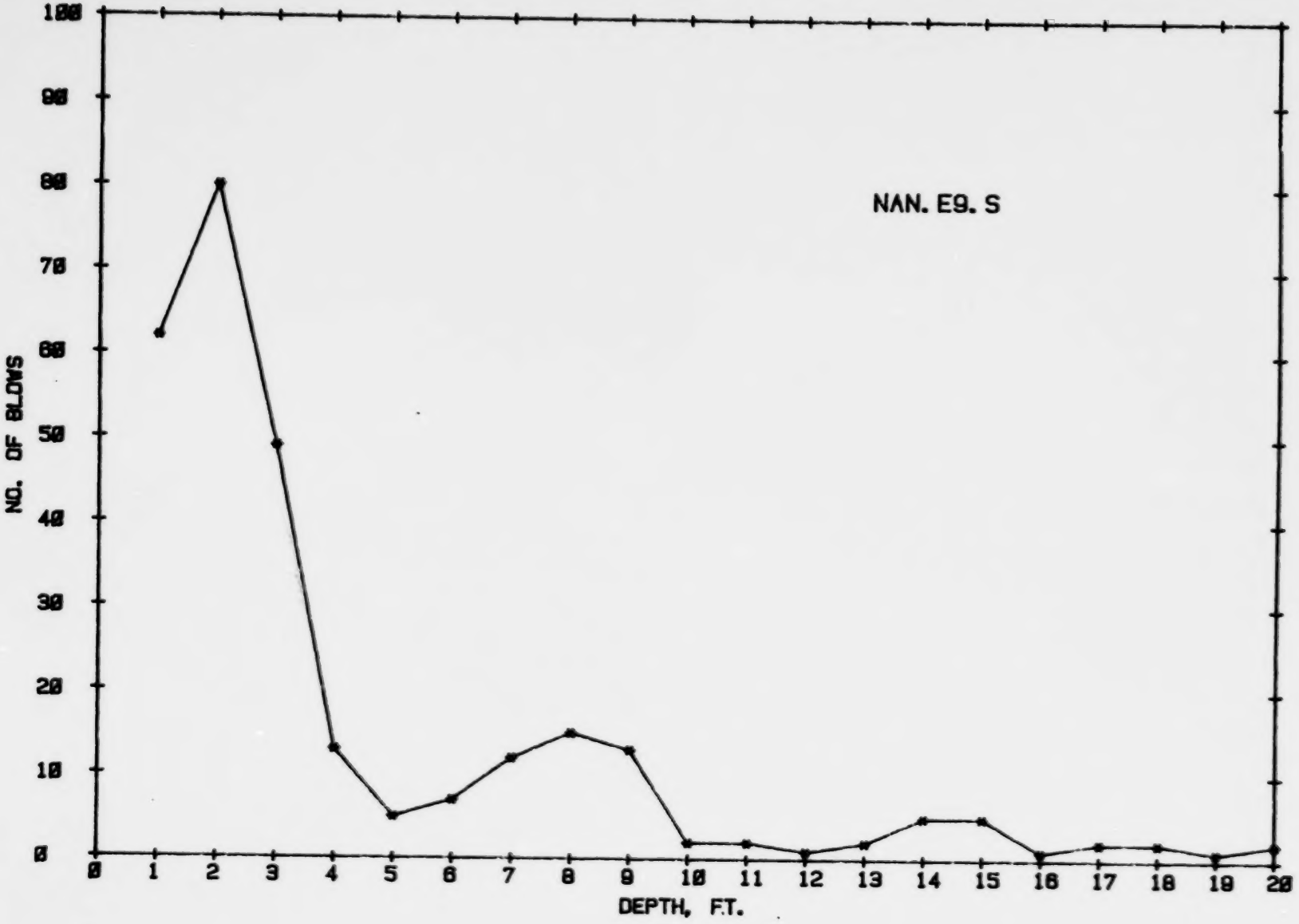
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. E9. S
NO. OF BLOWS
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10
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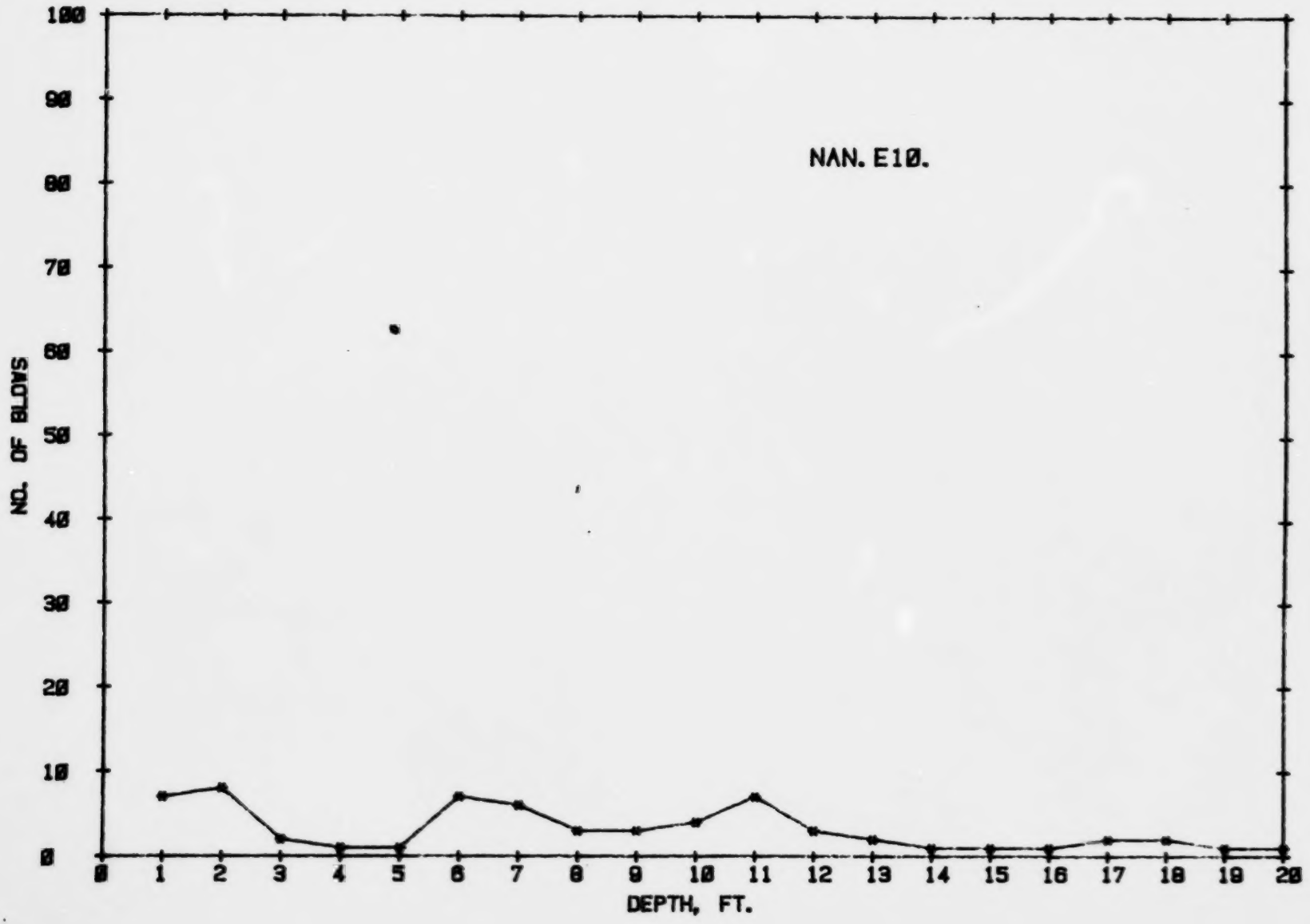
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, F.T.


NAN. E10.
NO. OF BLOWS
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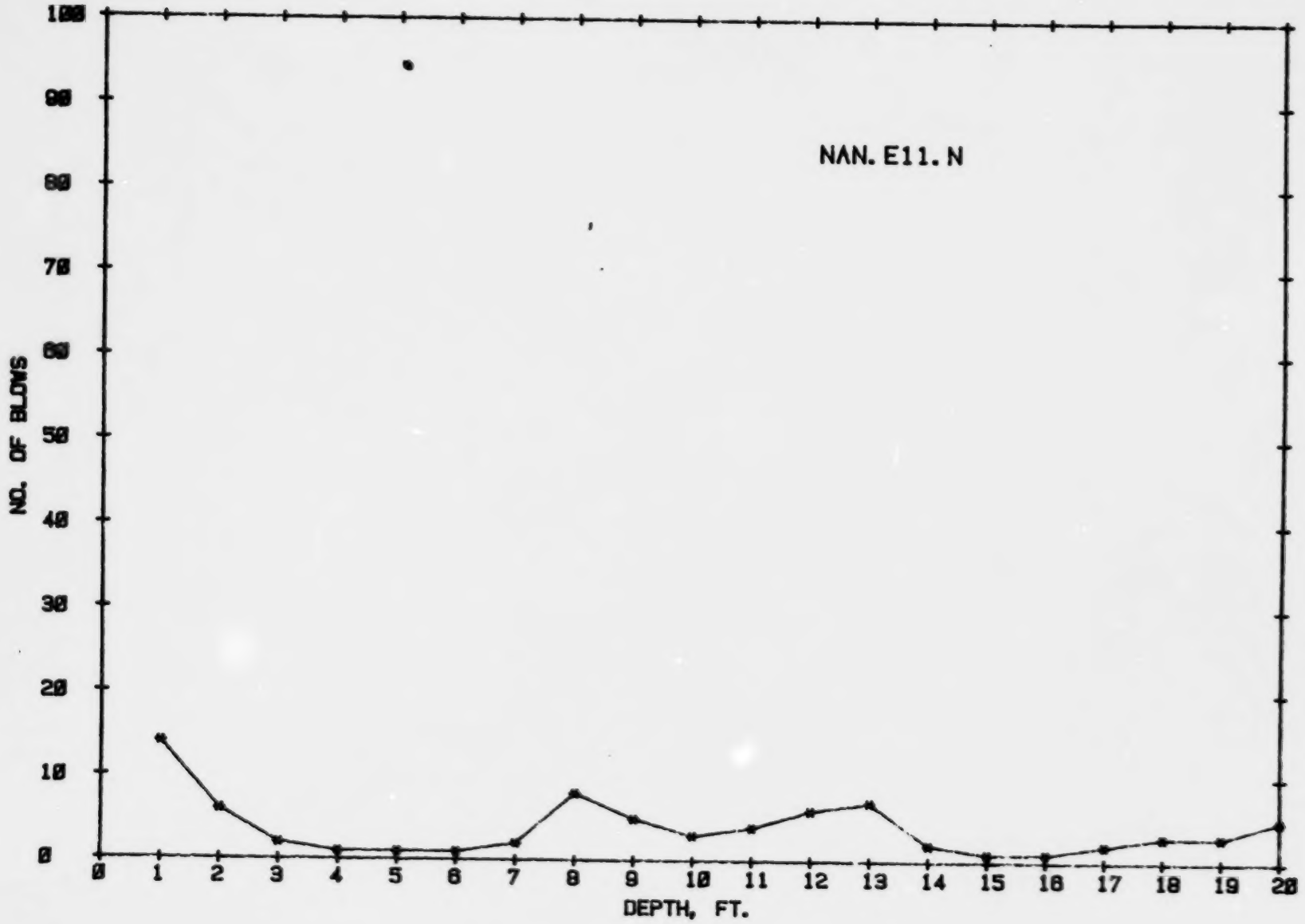
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. E11. N
NO. OF BLOWS
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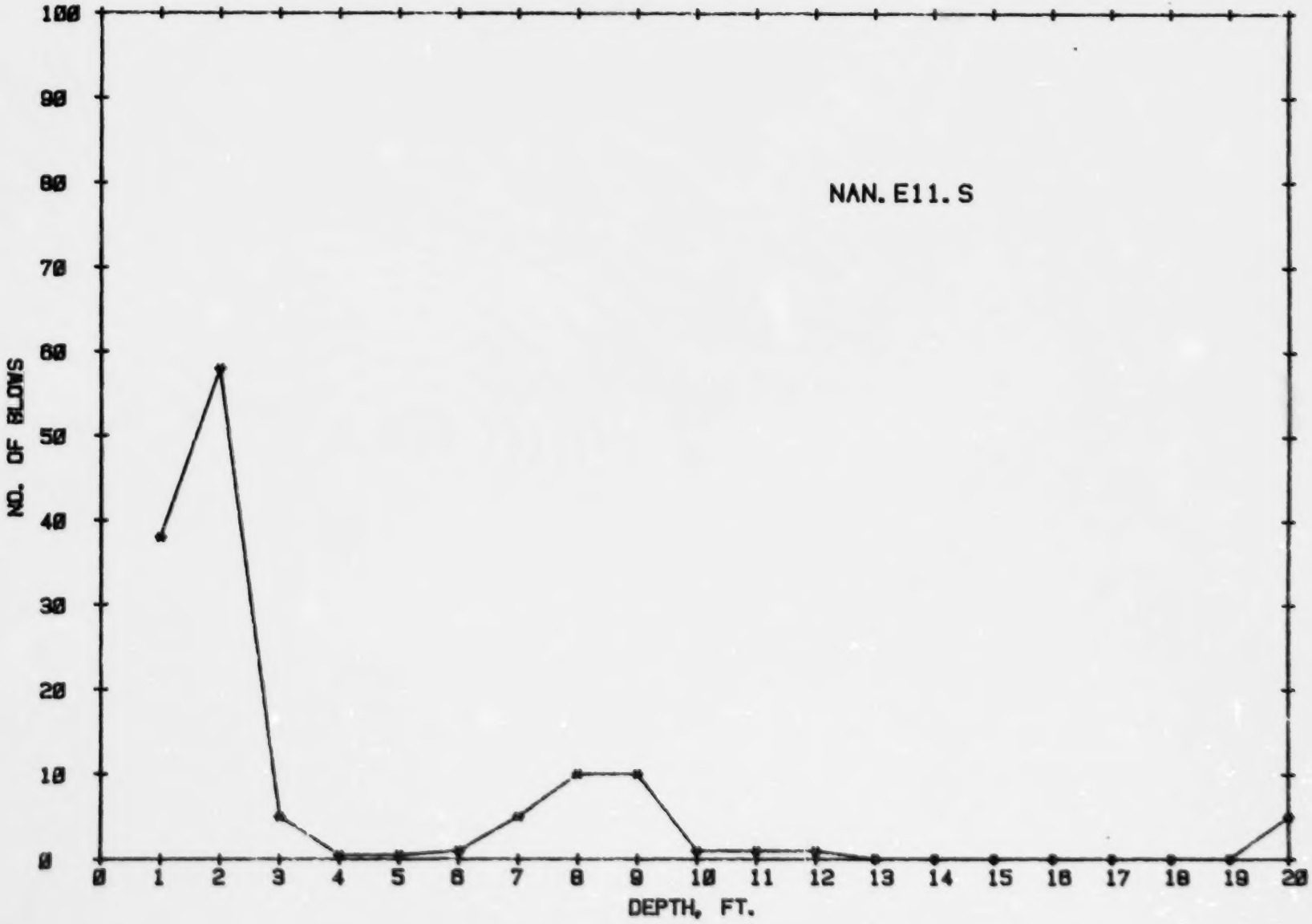
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. E11. S
NO. OF BLOWS
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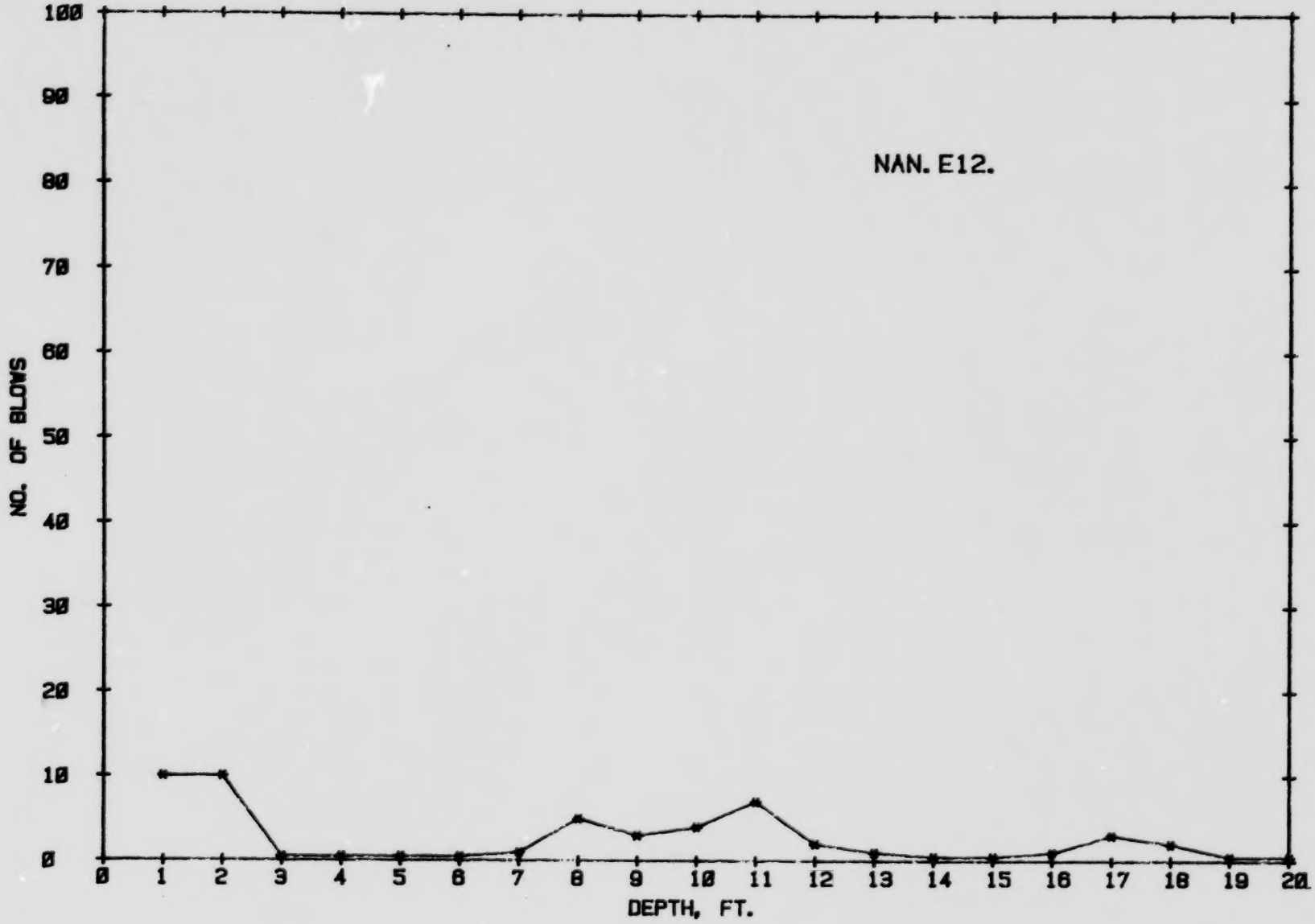
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. E12.
NO. OF BLOWS
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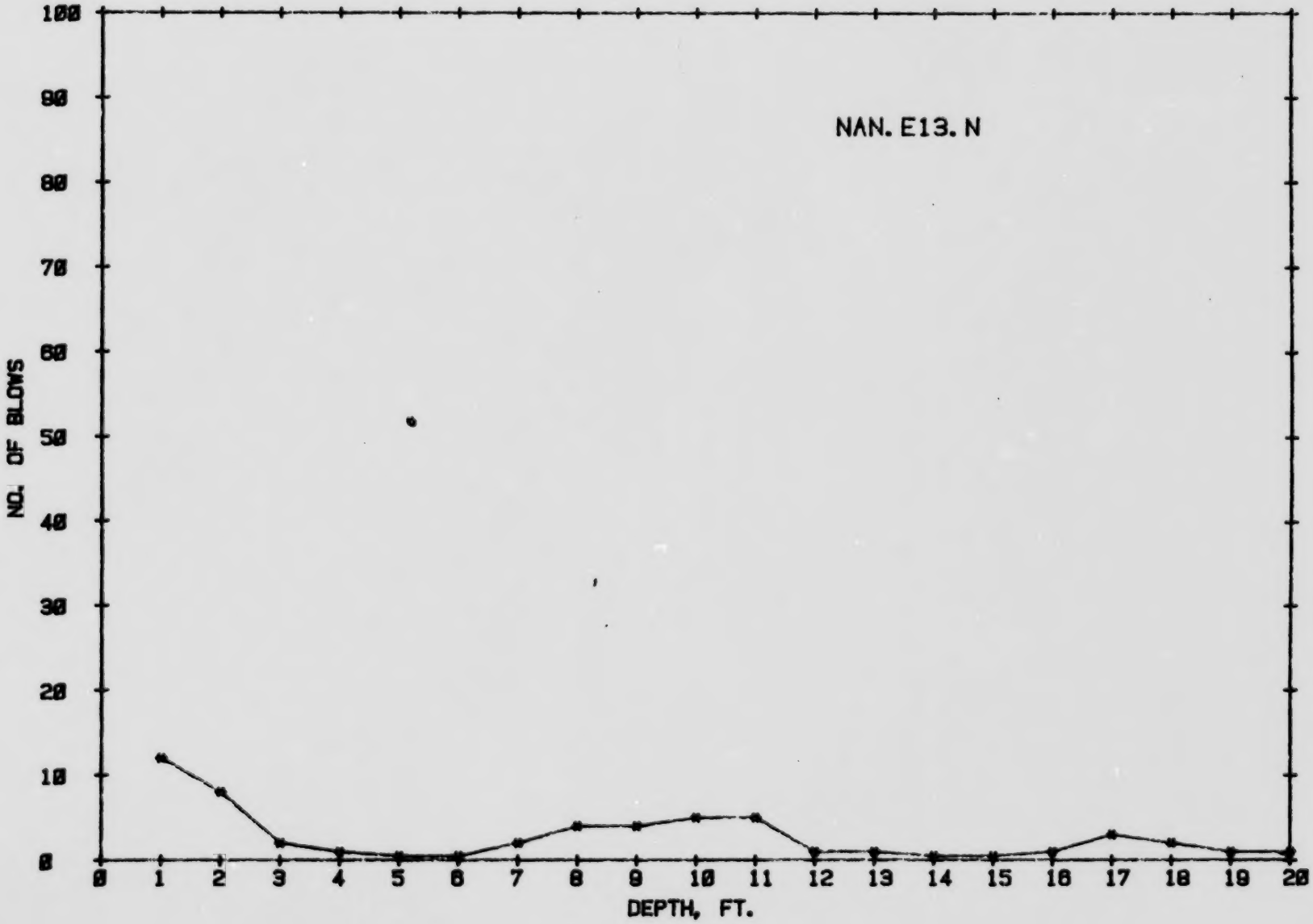
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. E13. N
NO. OF BLOWS
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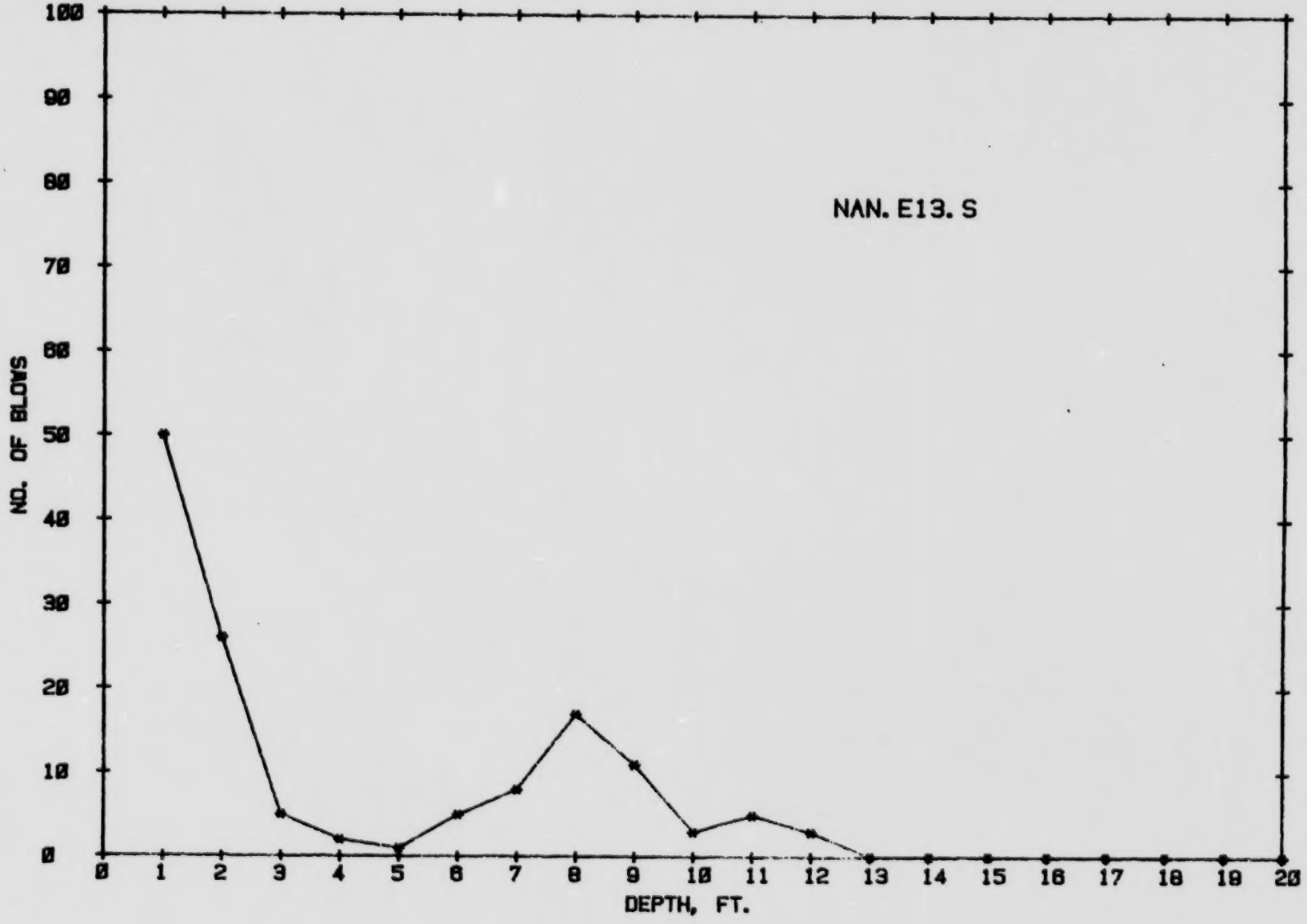
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. E13. S
NO. OF BLOWS
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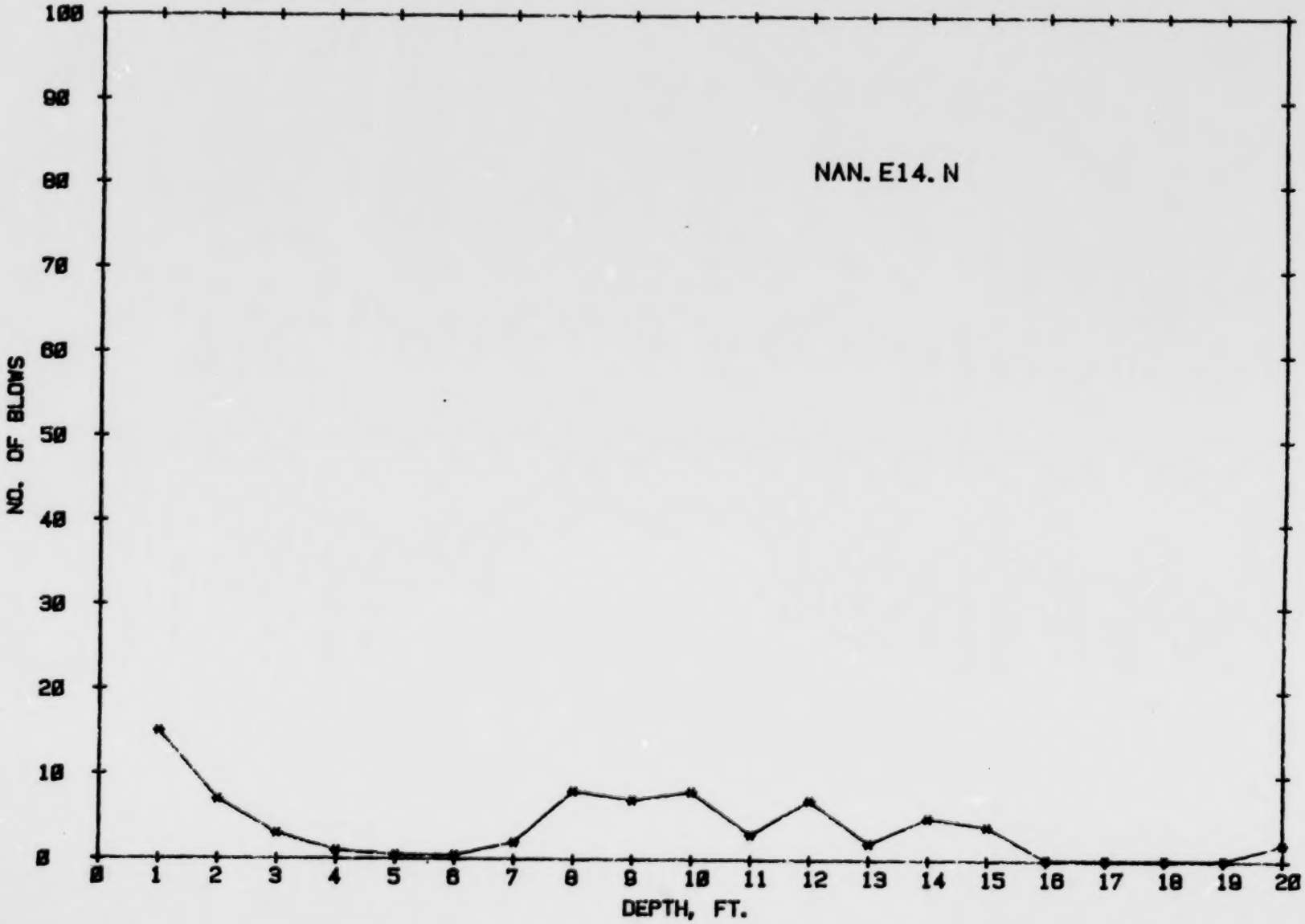
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. E14. N
NO. OF BLOWS
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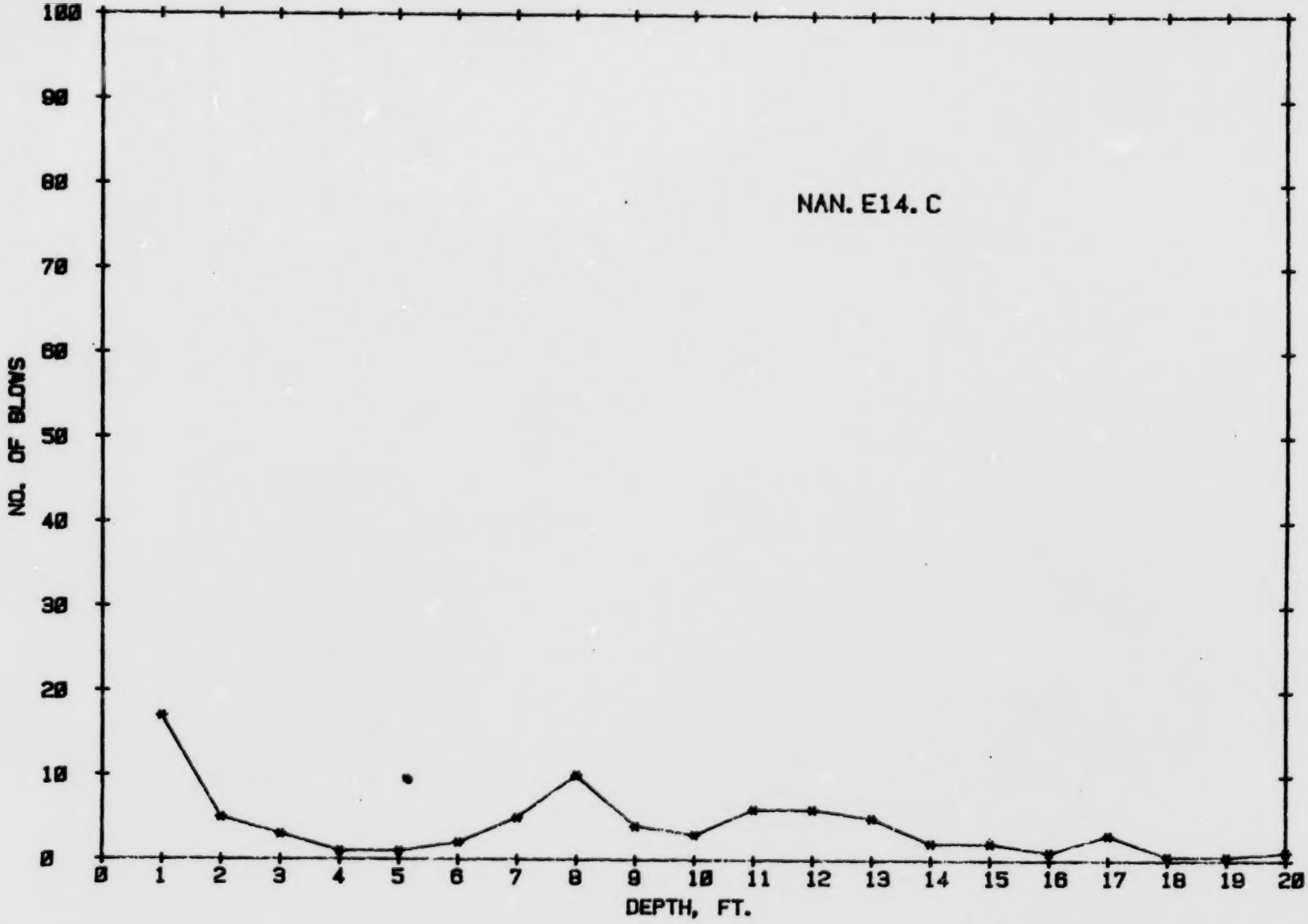
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. E14. C
NO. OF BLOWS
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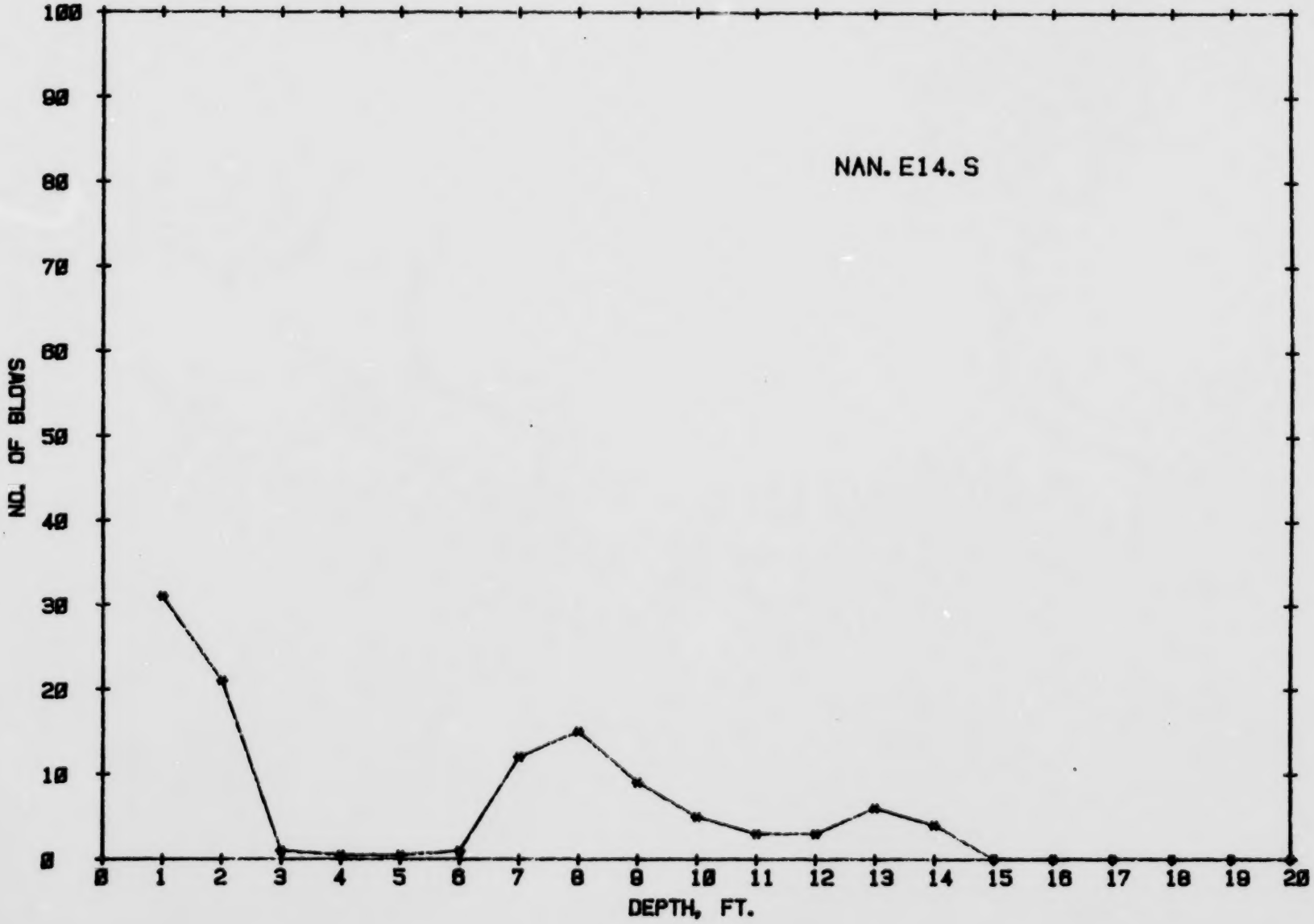
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. E14. S
NO. OF BLOWS
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20
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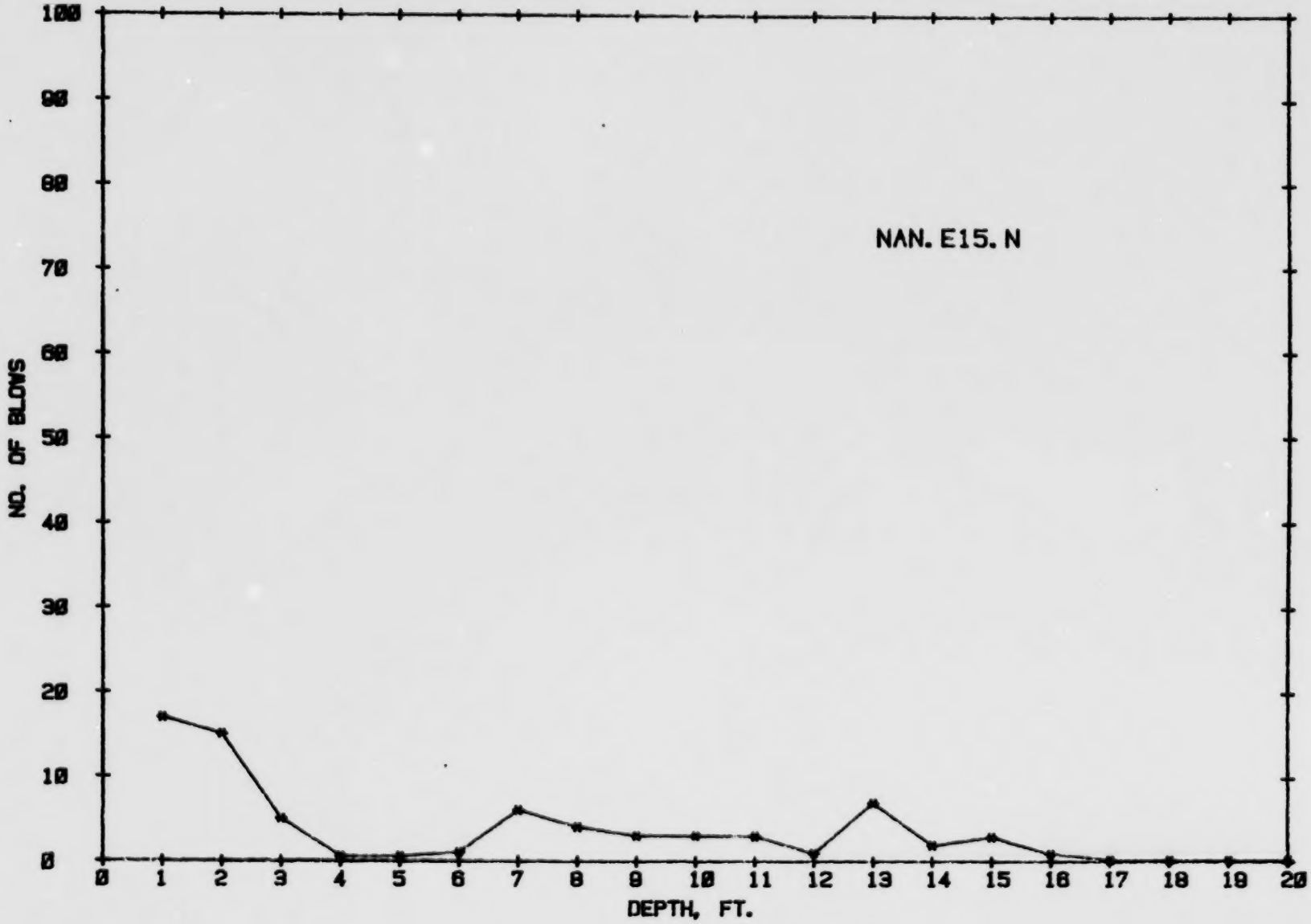
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. E15. N
NO. OF BLOWS
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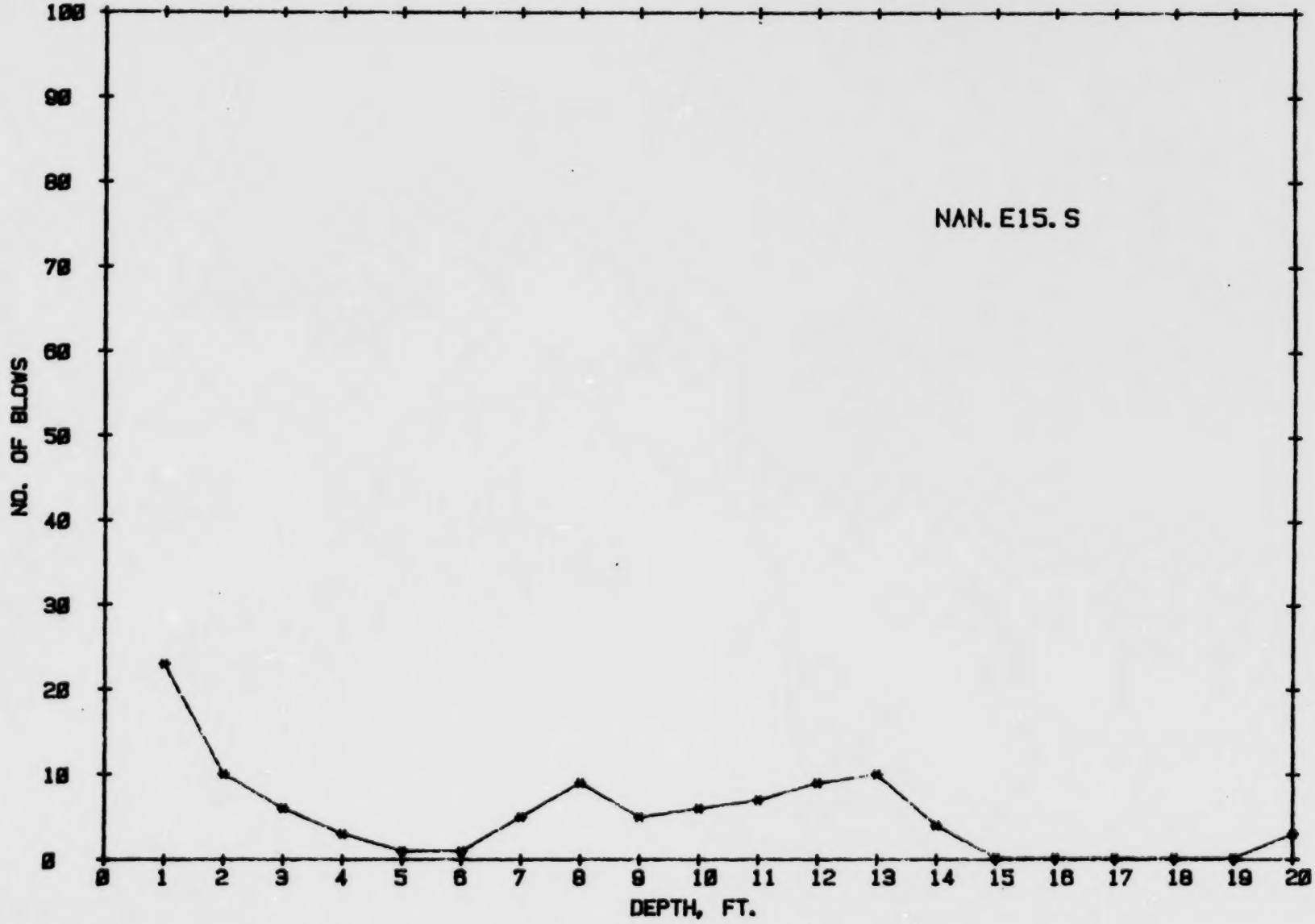
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. E15. S
NO. OF BLOWS
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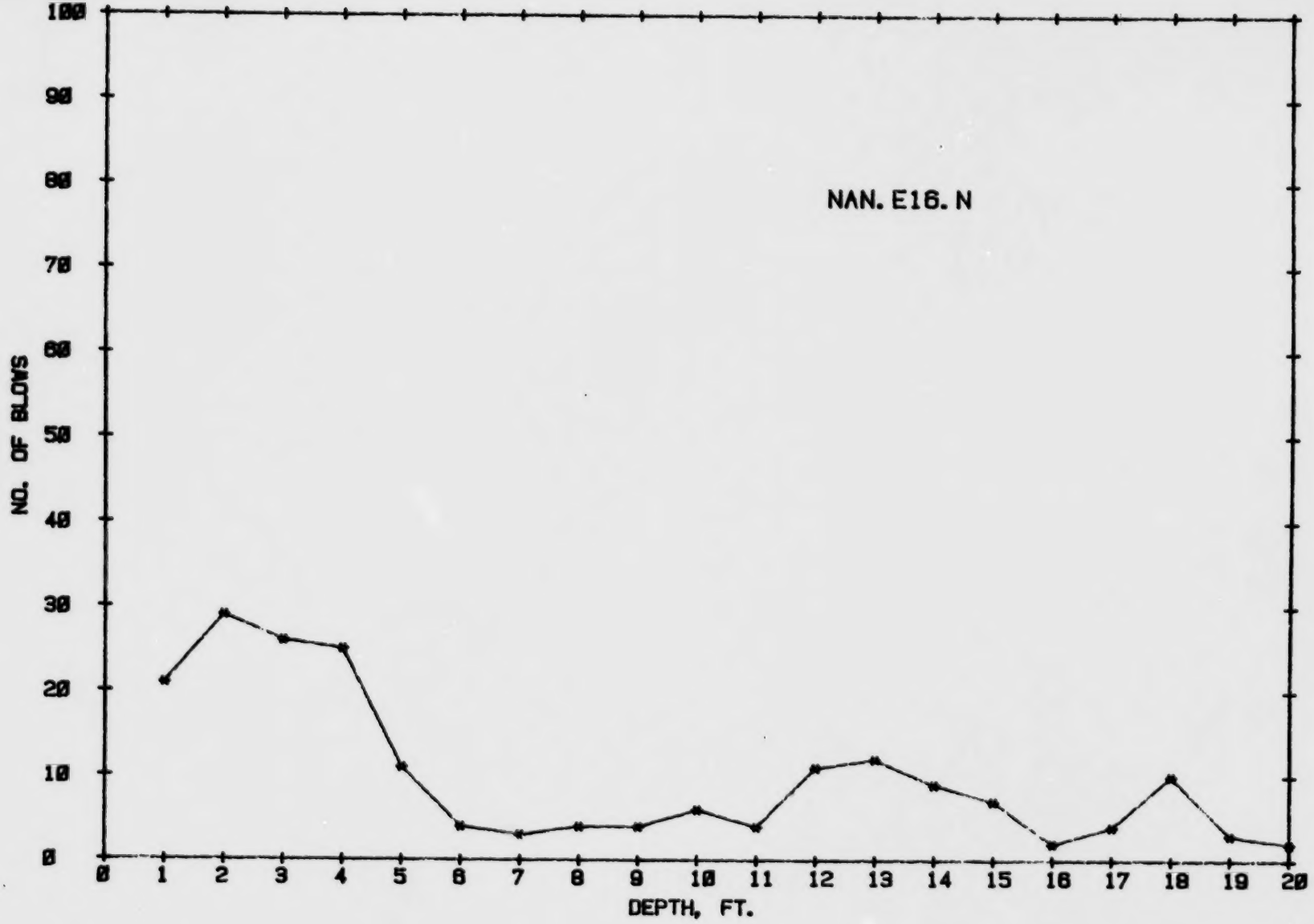
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. E16. N
NO. OF BLOWS
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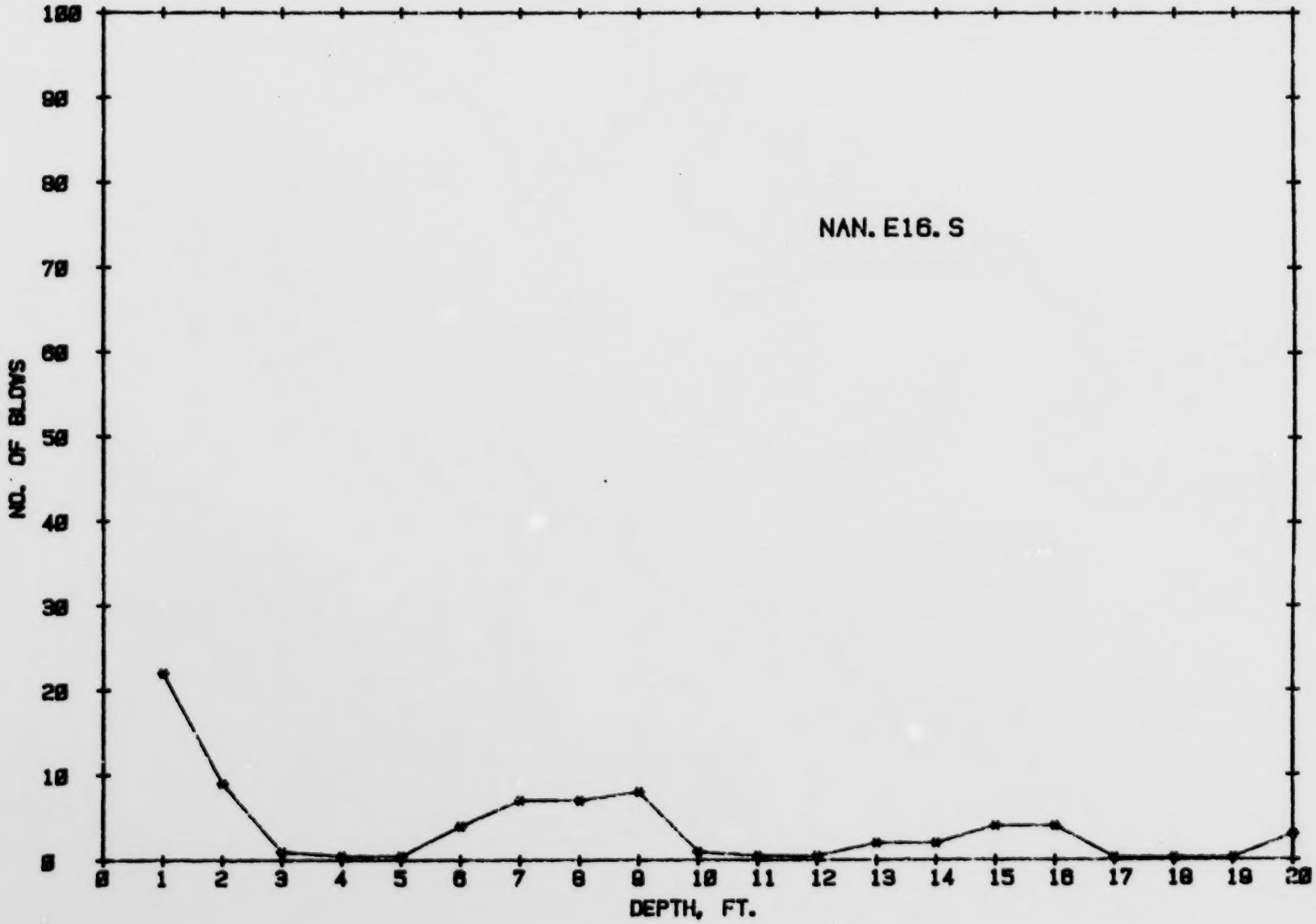
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. E16. S
NO. OF BLOWS
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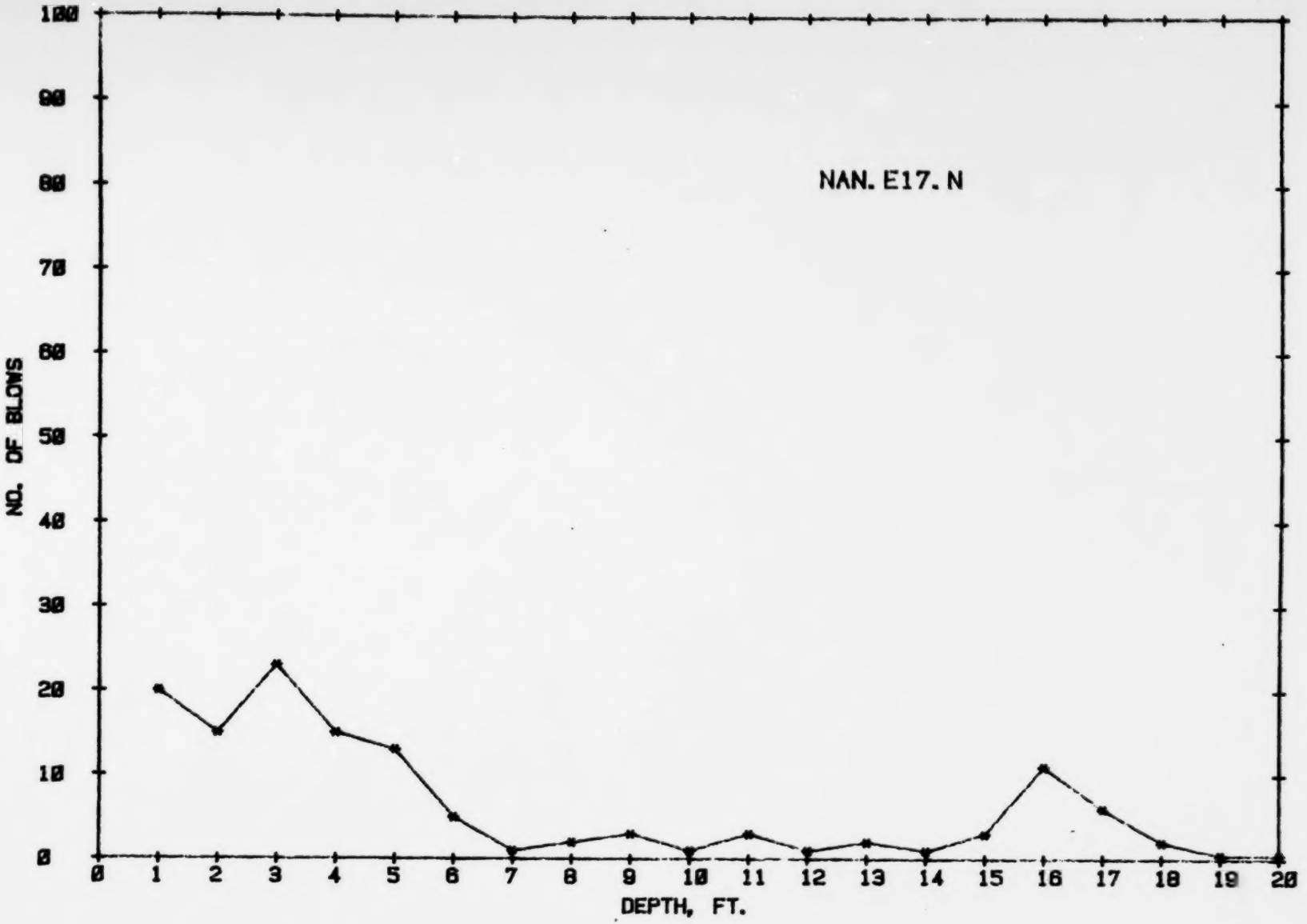
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. E17. N
NO. OF BLOWS
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10
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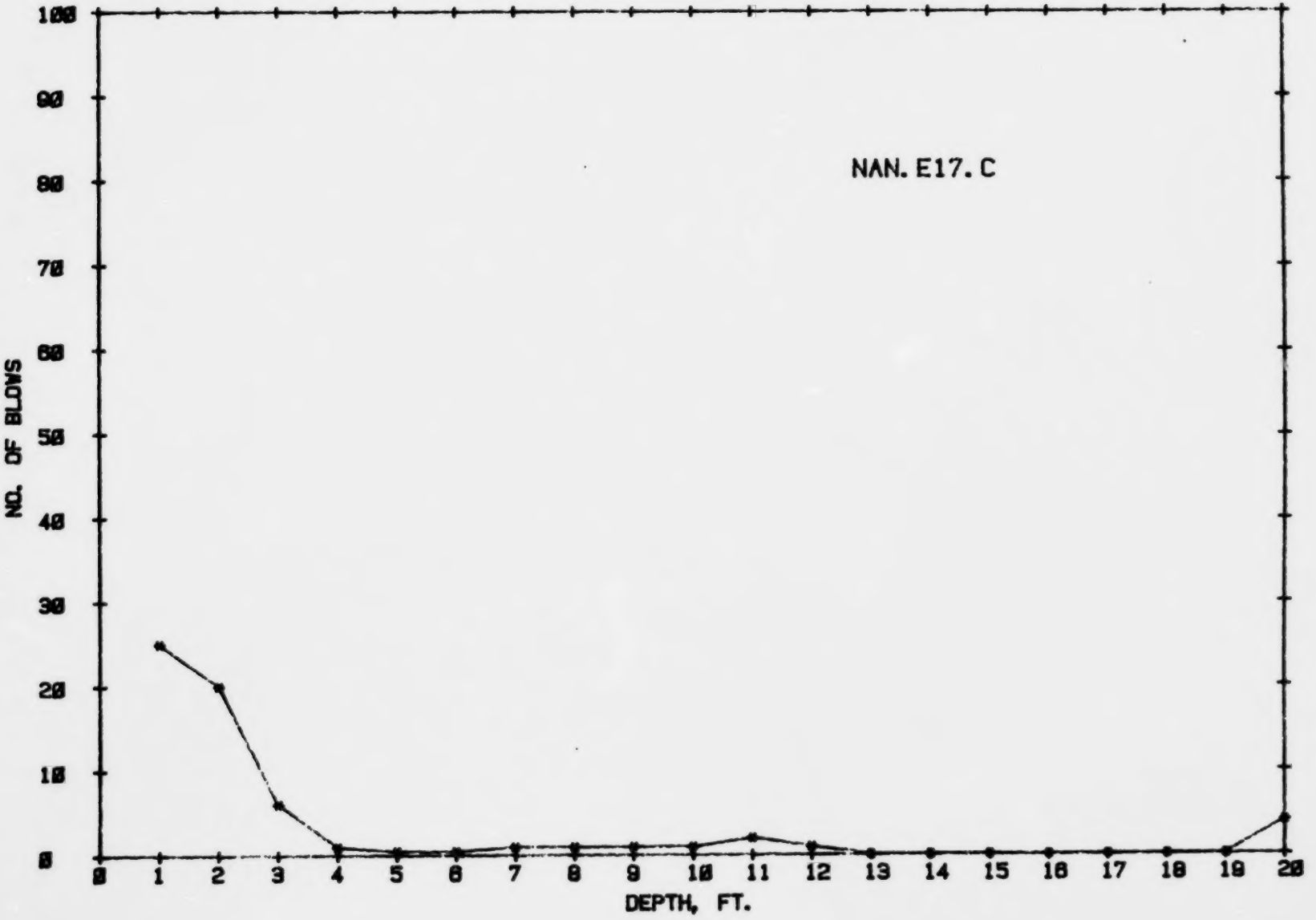
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. E17. C
NO. OF BLOWS
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10
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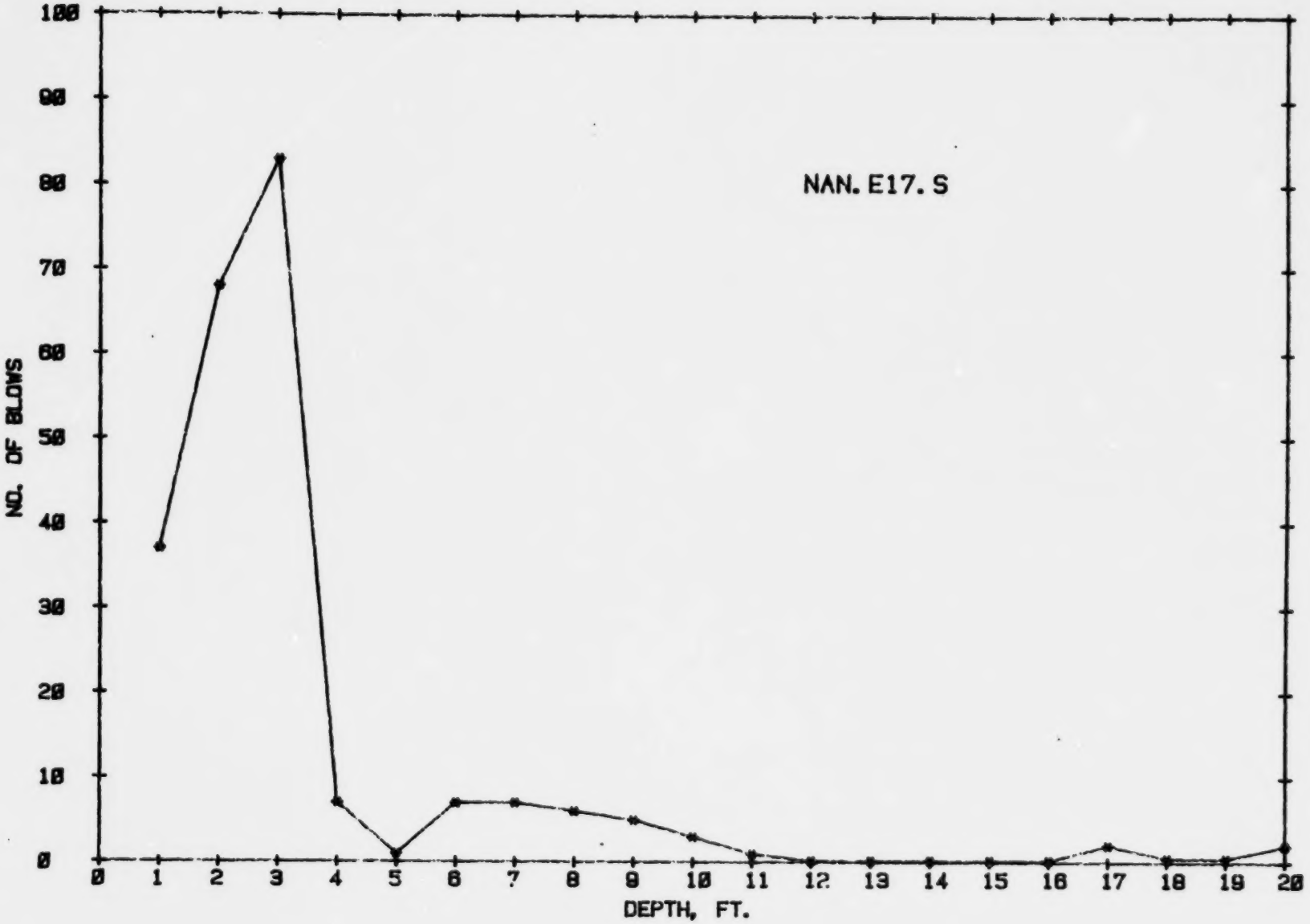
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. E17. S
NO. OF BLOWS
DEPTH, FT.
100
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40
30
20
10
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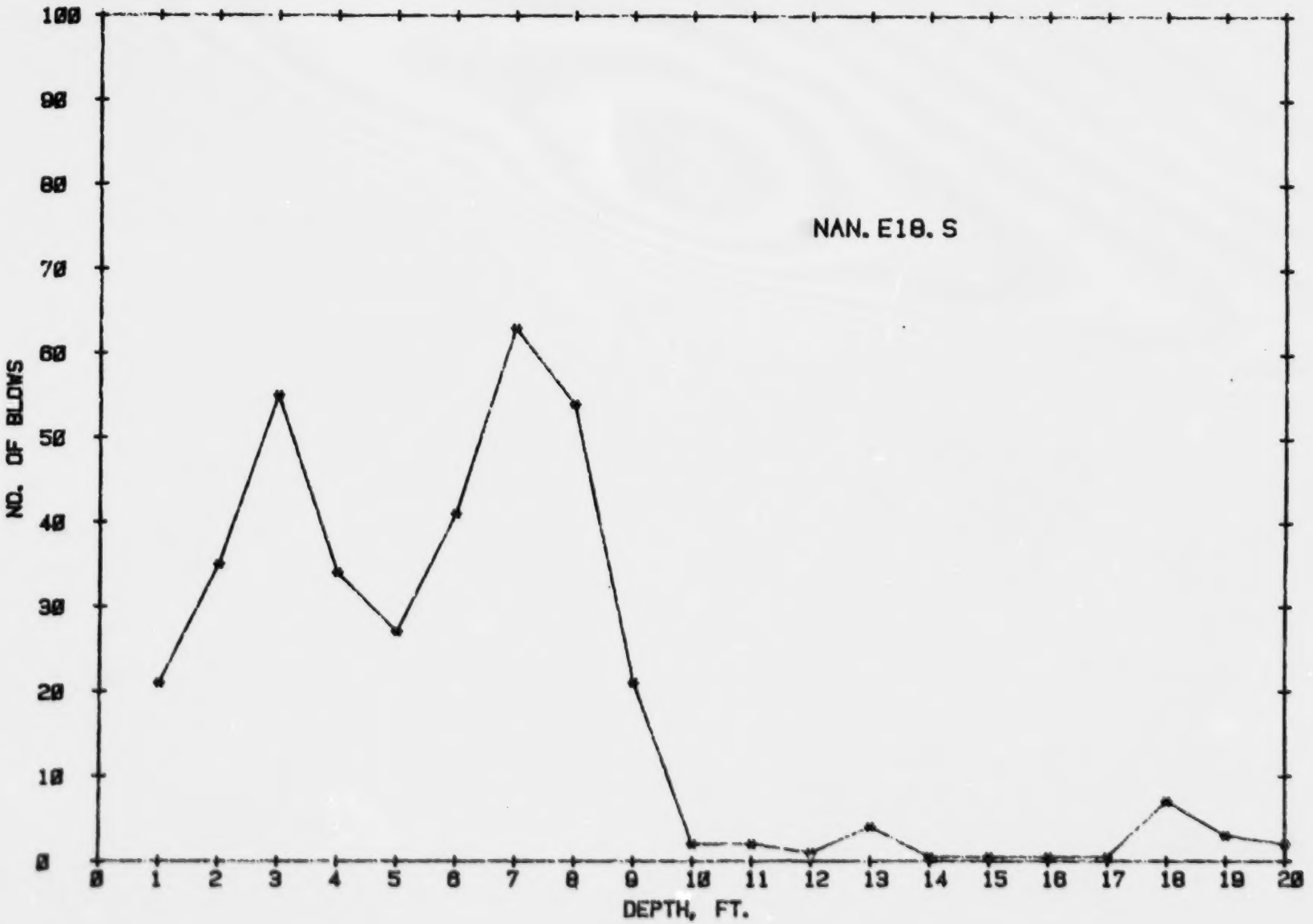
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20


NAN. E18. S
NO. OF BLOWS
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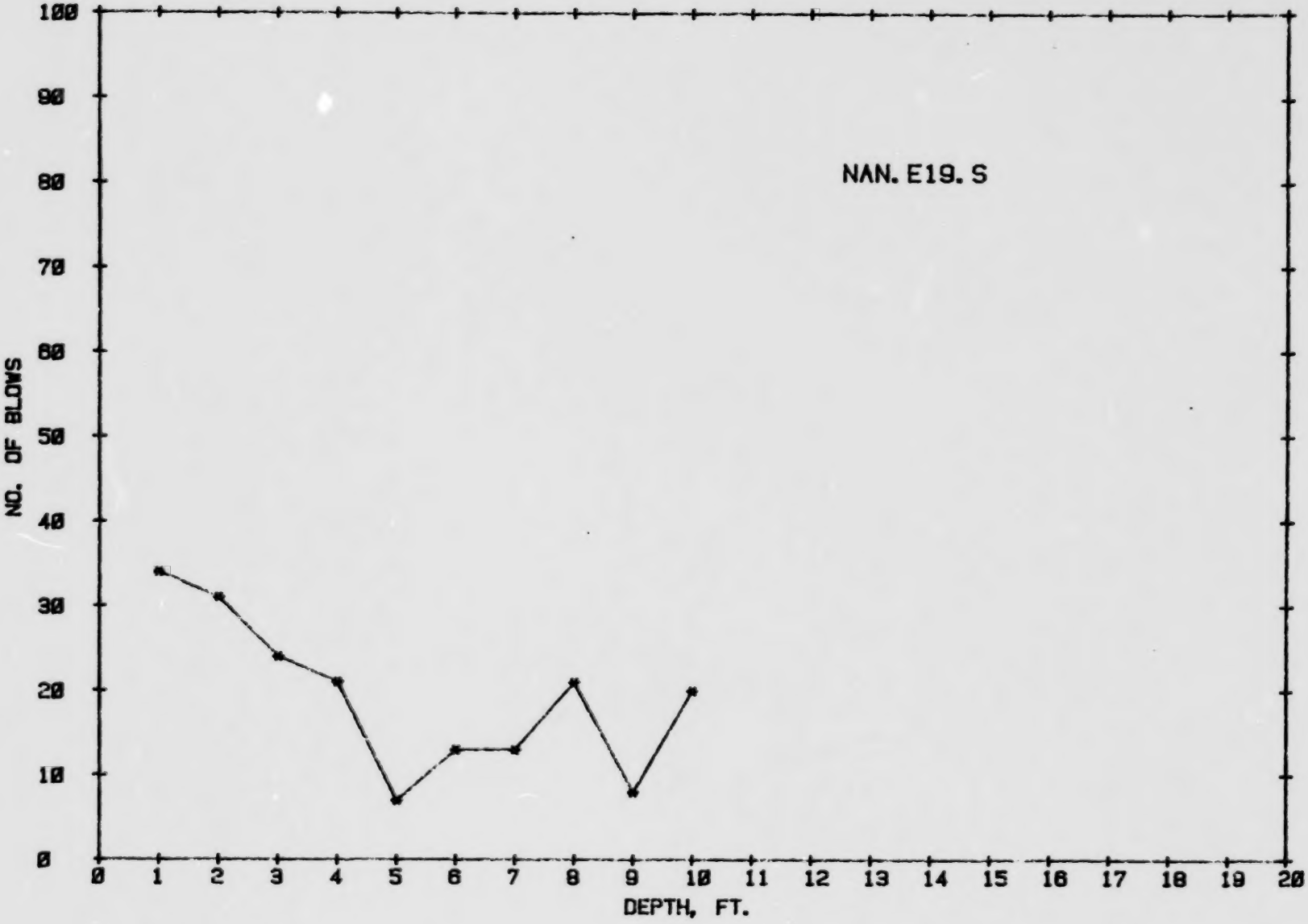
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. E19. S
NO. OF BLOWS
DEPTH, FT.
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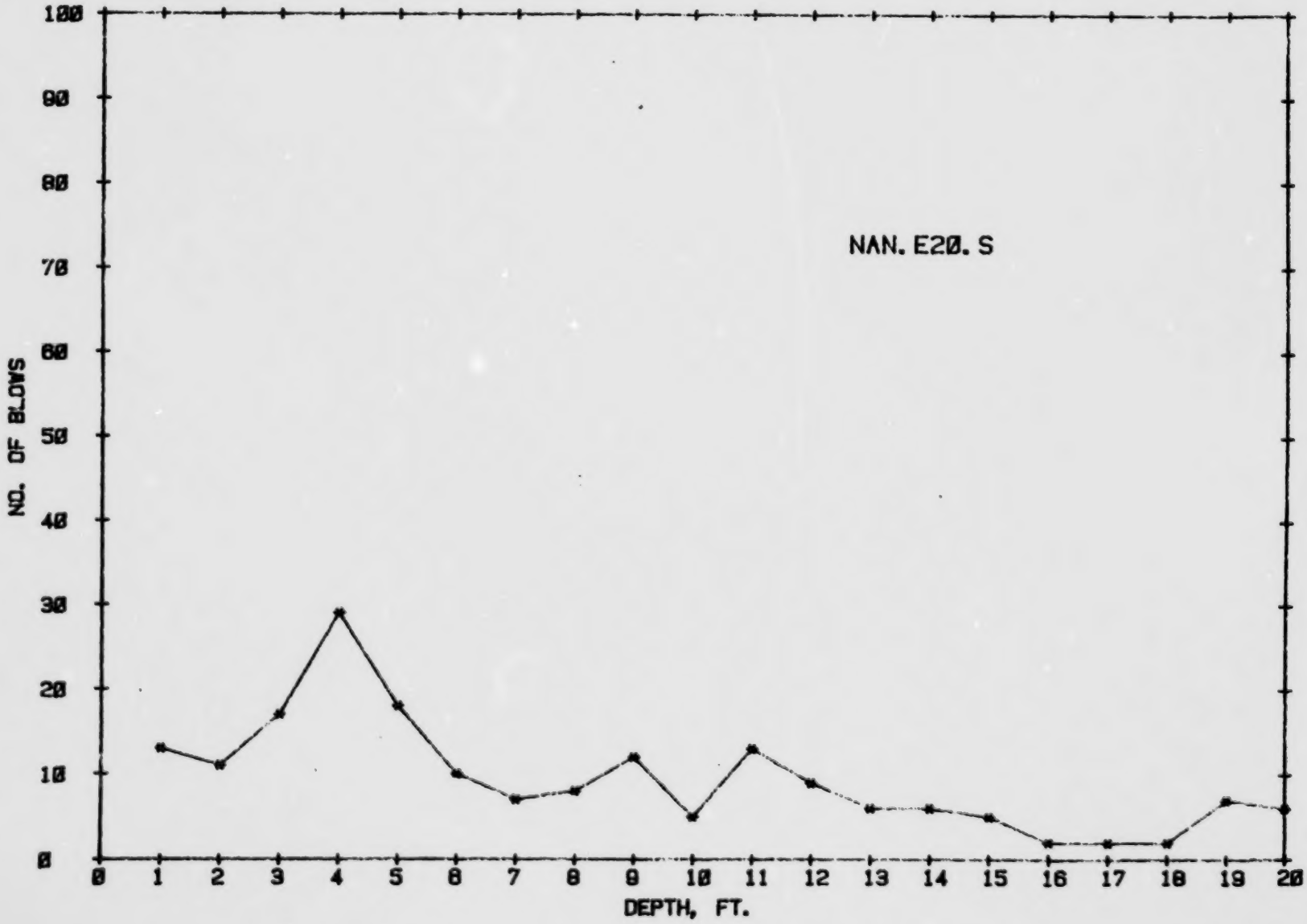
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20


NAN. E20. S
NO. OF BLOWS
DEPTH, FT.
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90
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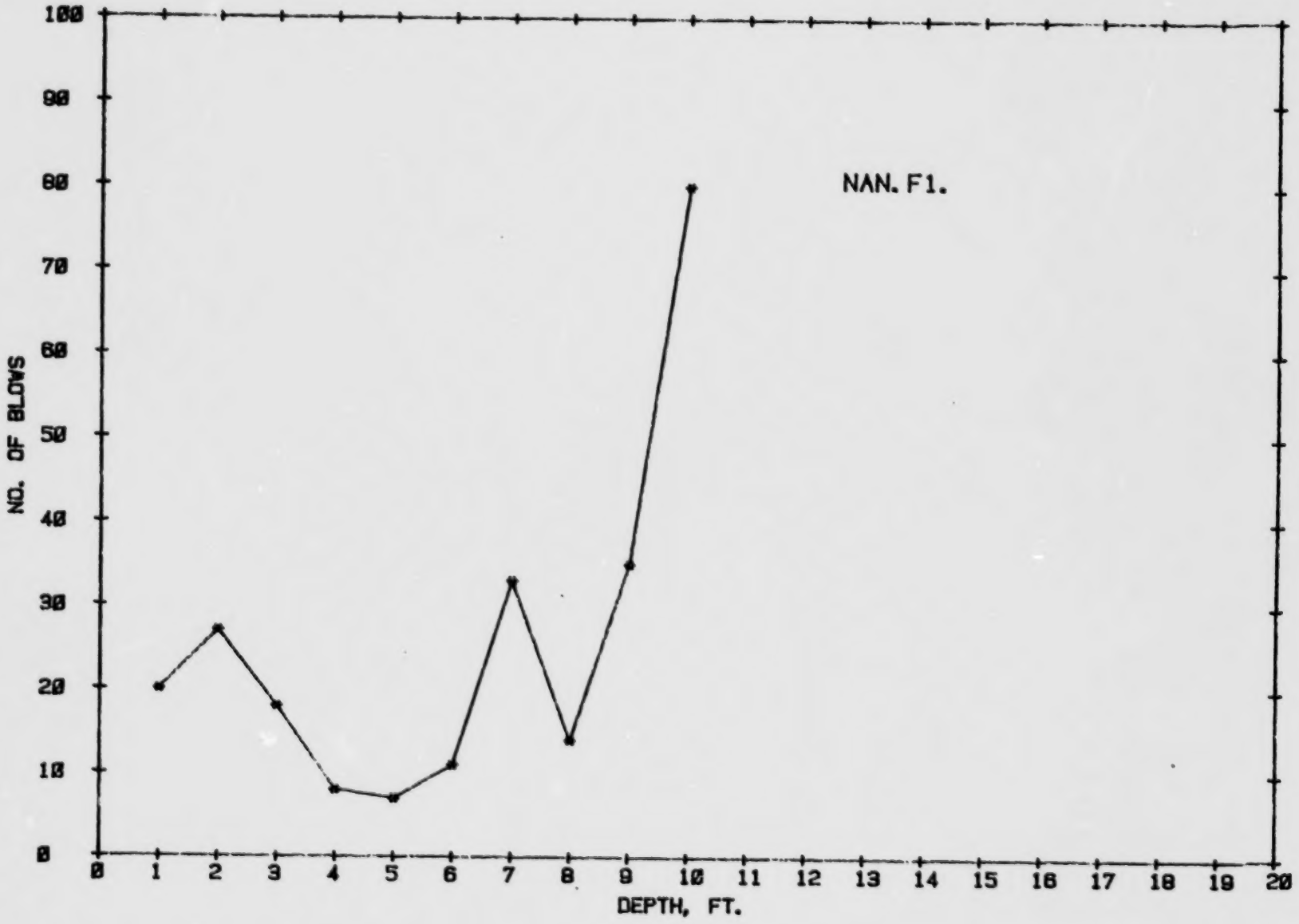
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20


NAN. F1.
NO. OF BLOWS
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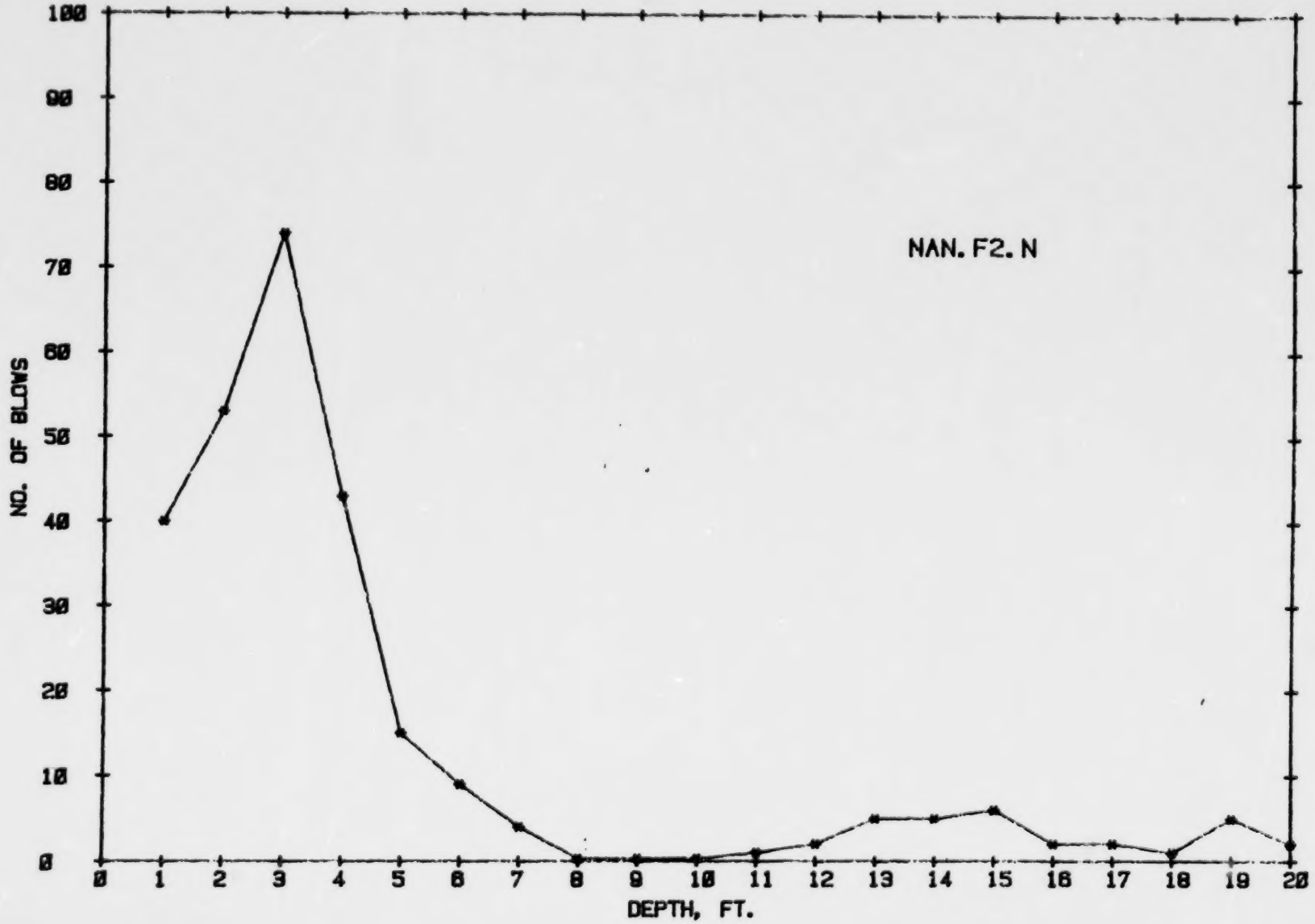
80
90
100
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. F2. N
NO. OF BLOWS
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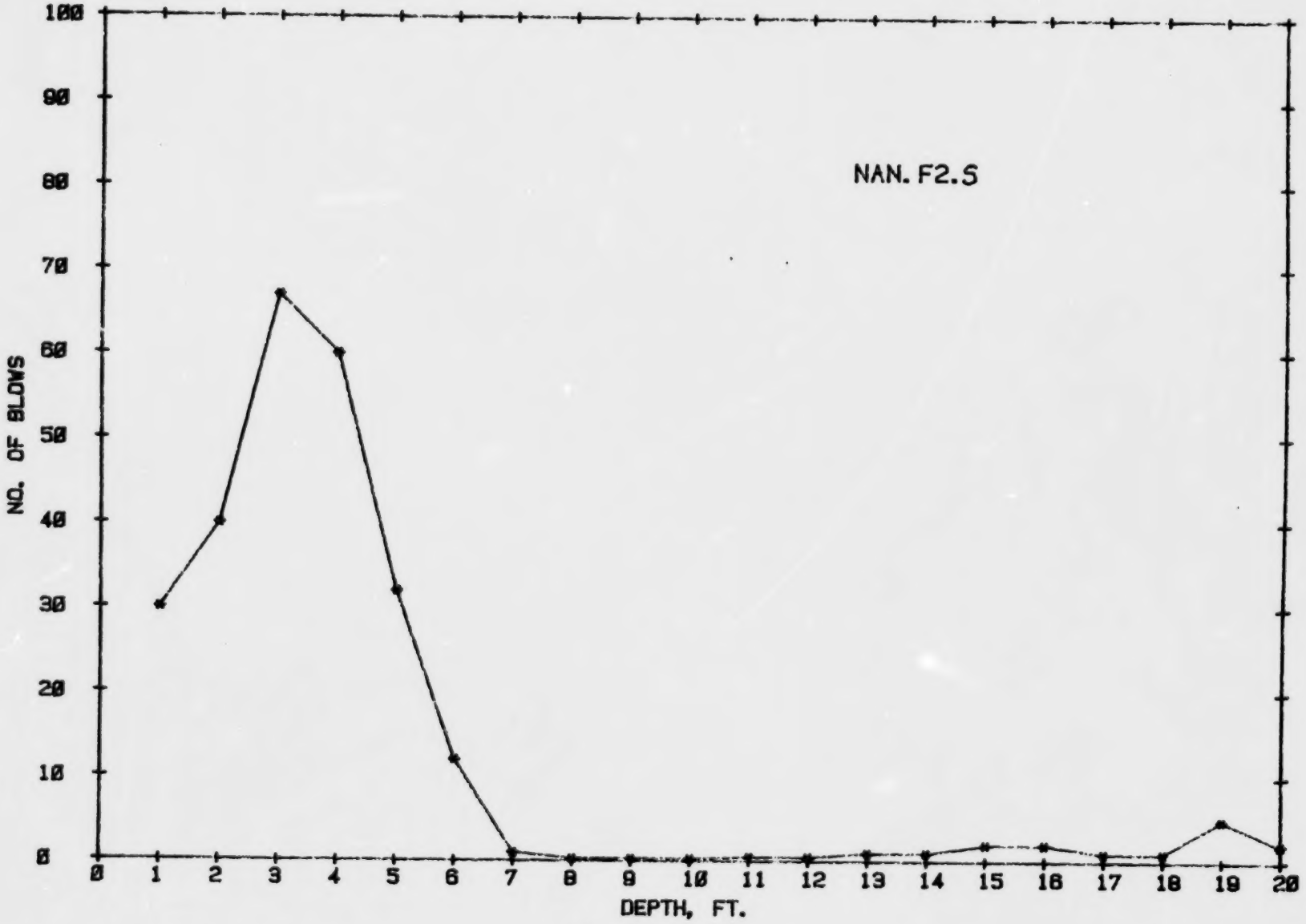
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. F2.S
NO. OF BLOWS
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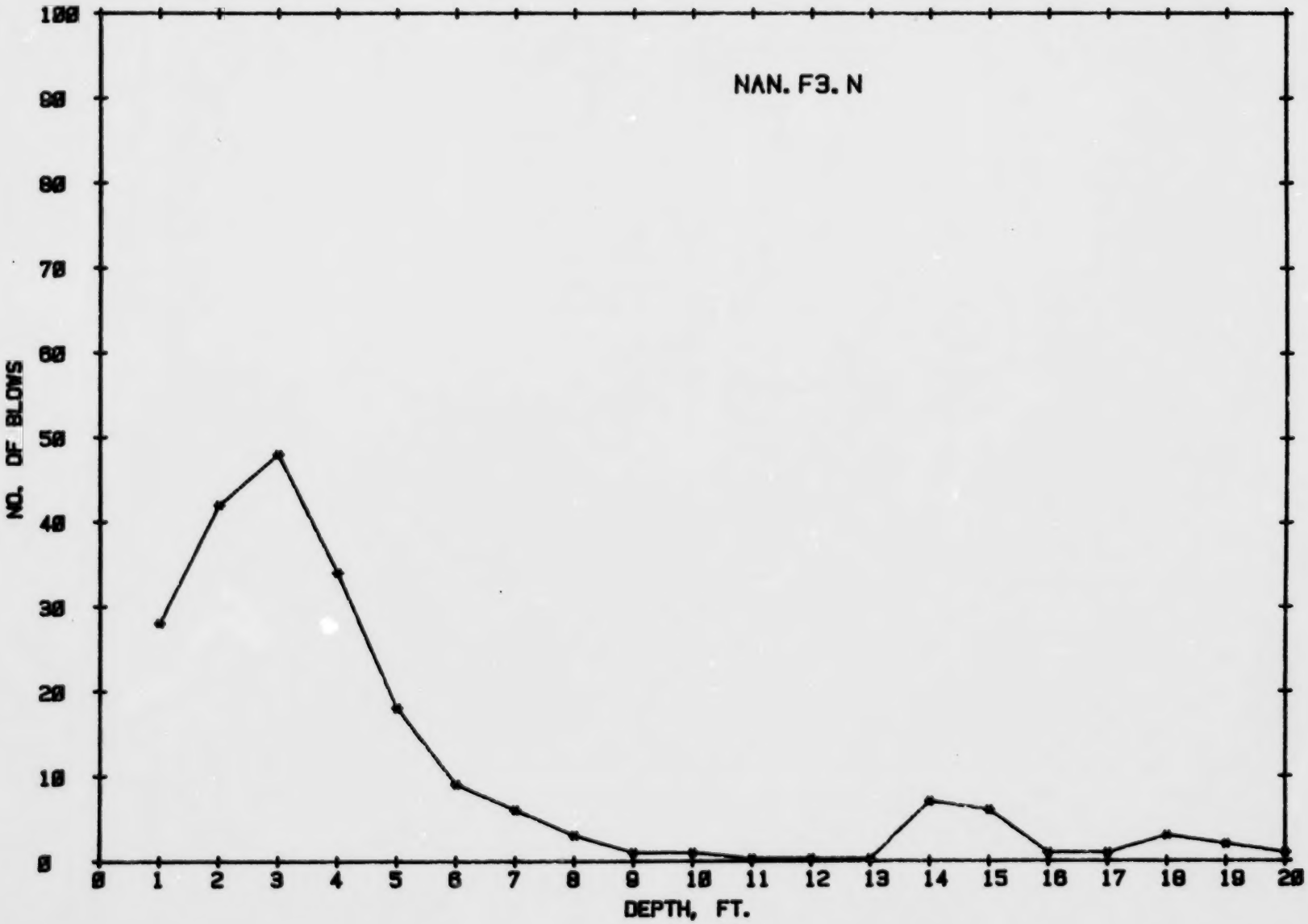
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. F3. N
NO. OF BLOWS
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50
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10
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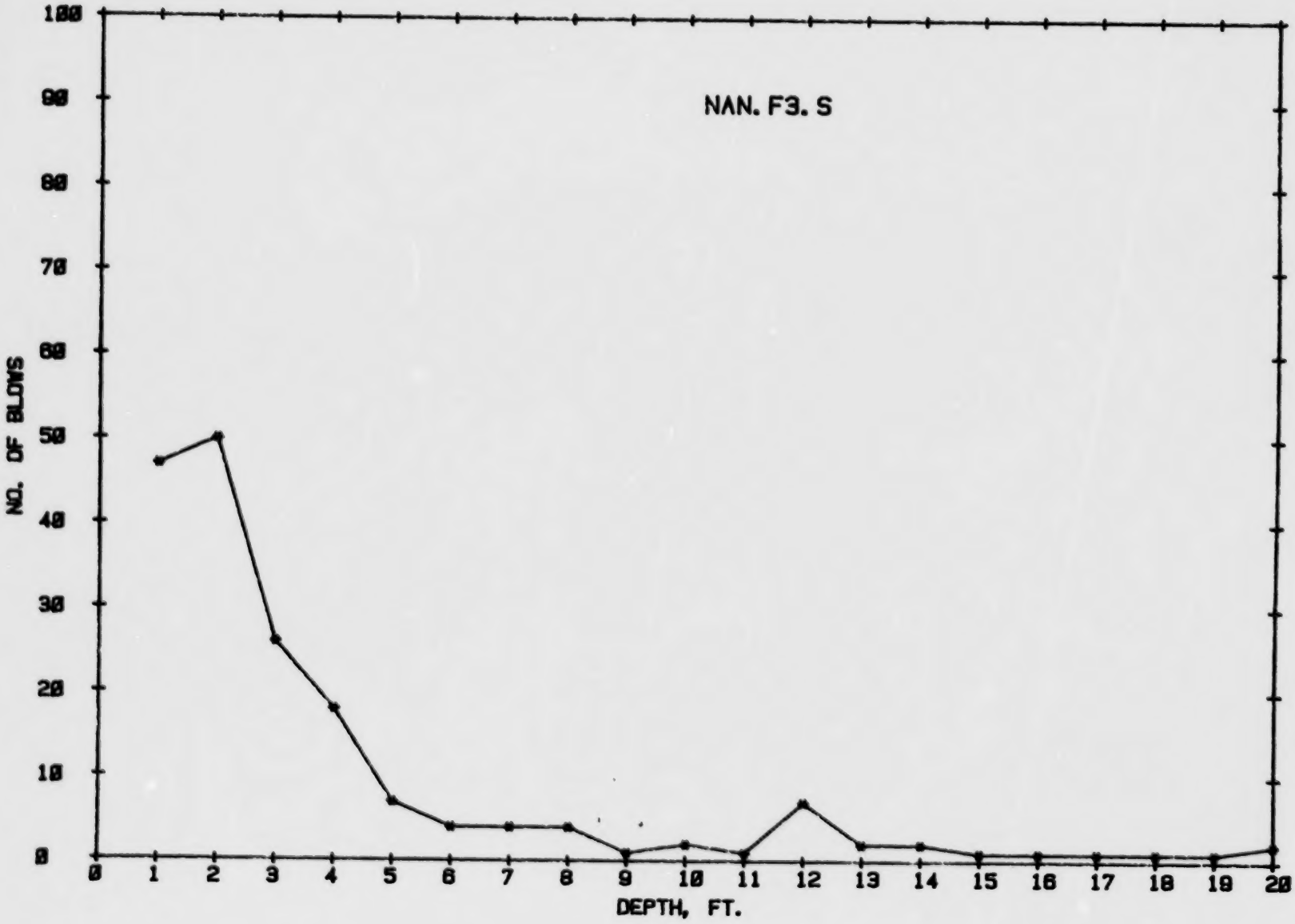
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. F3. S
NO. OF BLOWS
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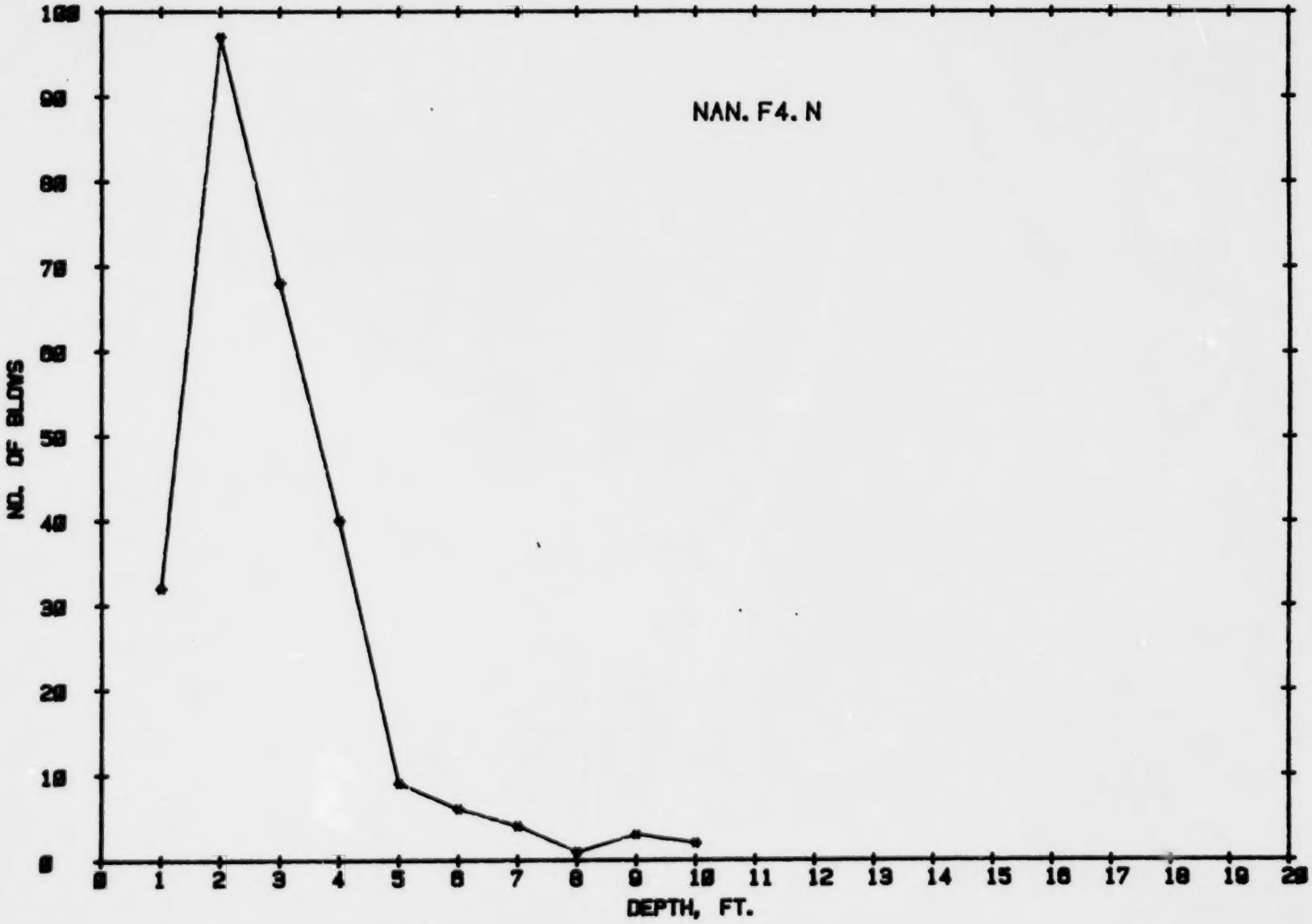
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. F4. N
NO. OF BLOWS
DEPTH, FT.
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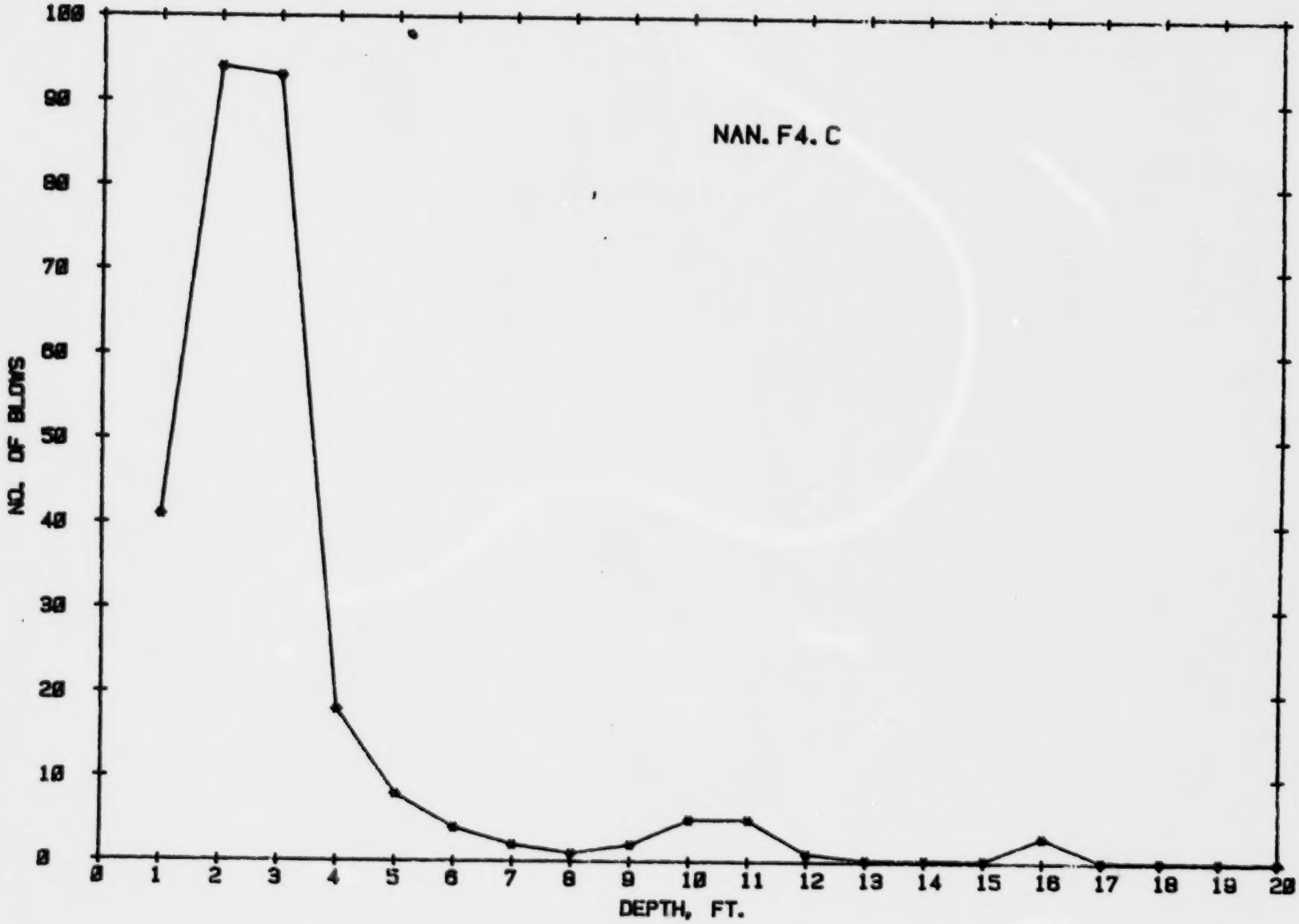
NAN. F4. C
NO. OF BLOWS
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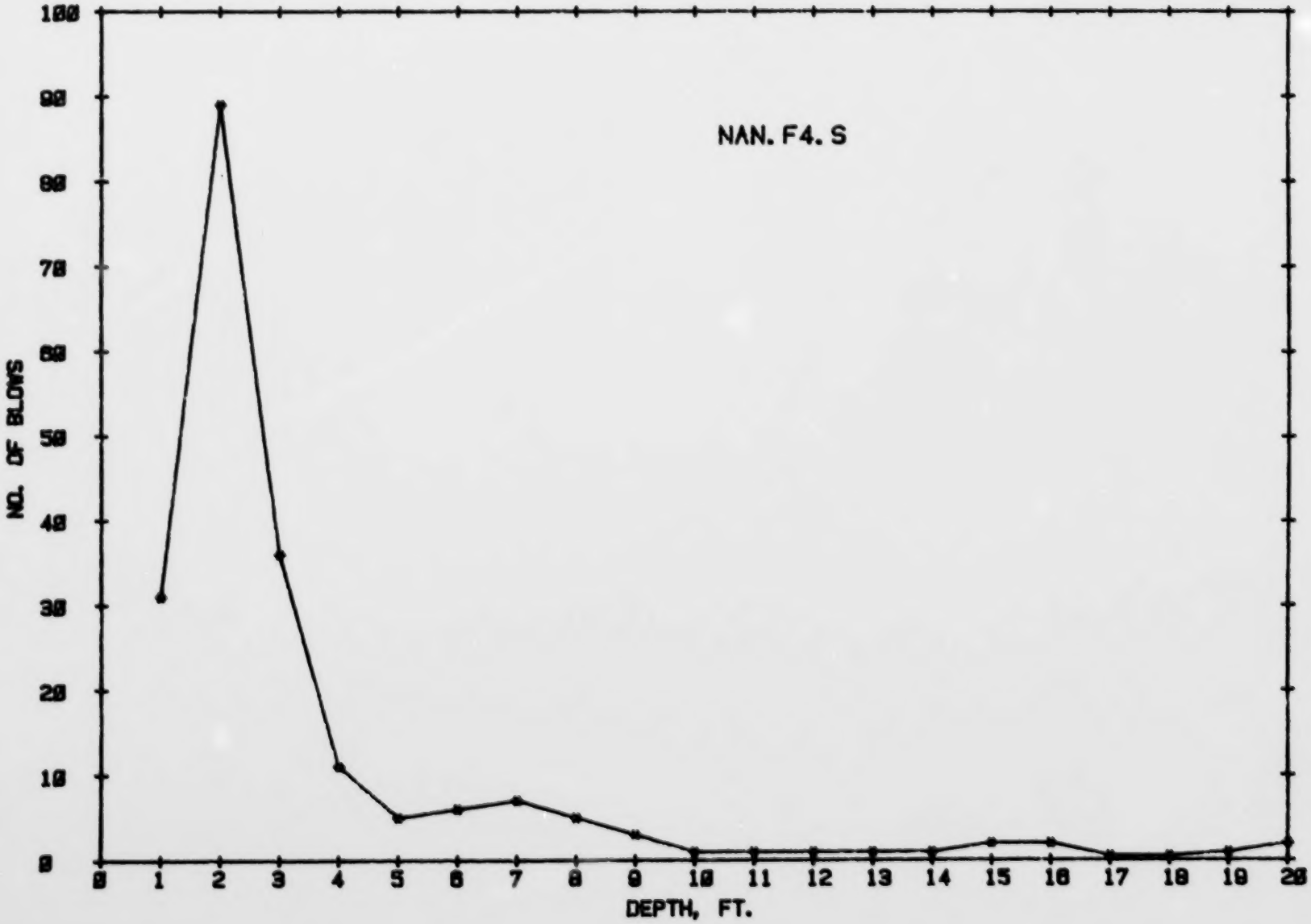
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. F4. S
NO. OF BLOWS
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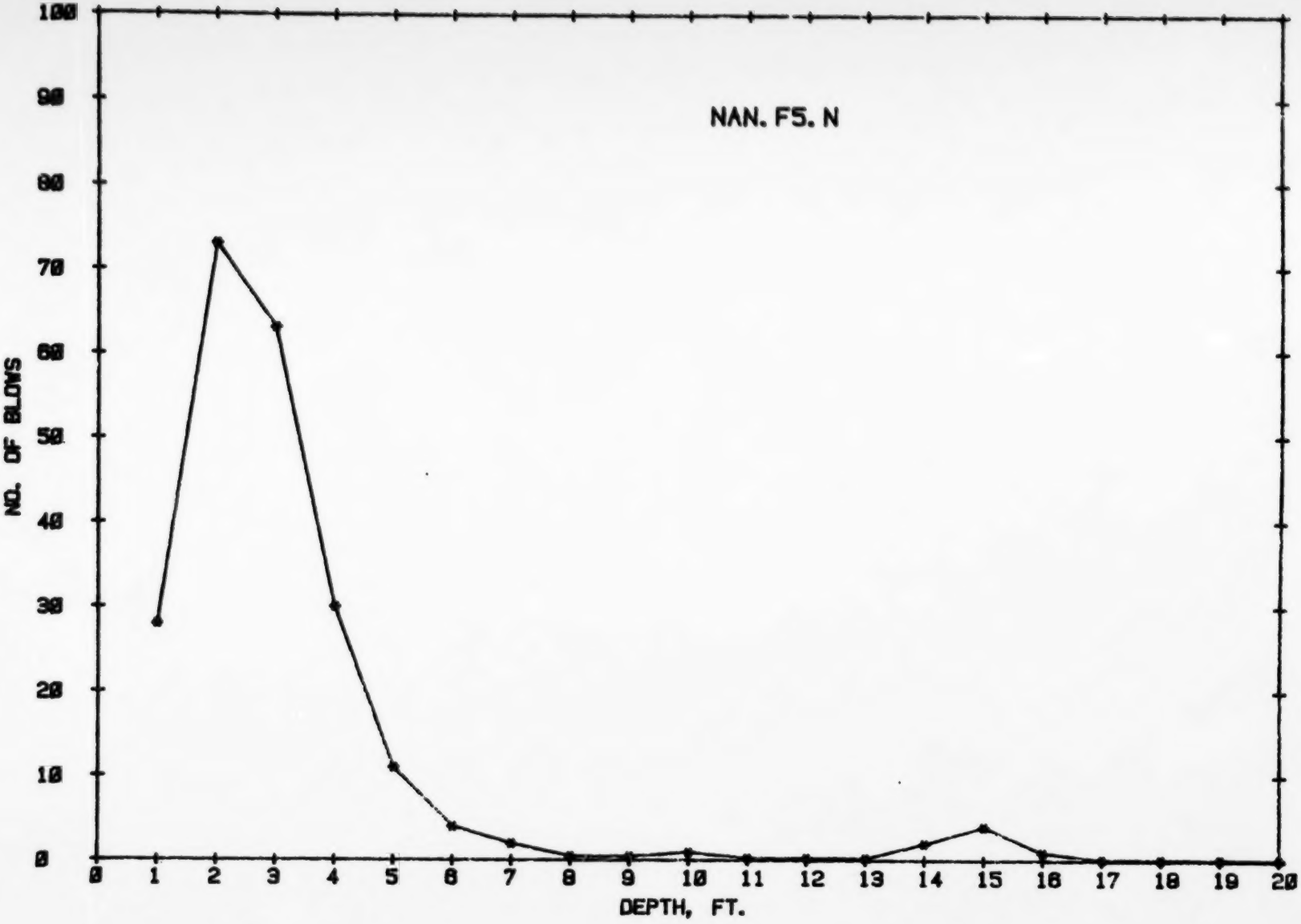
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. F5. N
NO. OF BLOWS
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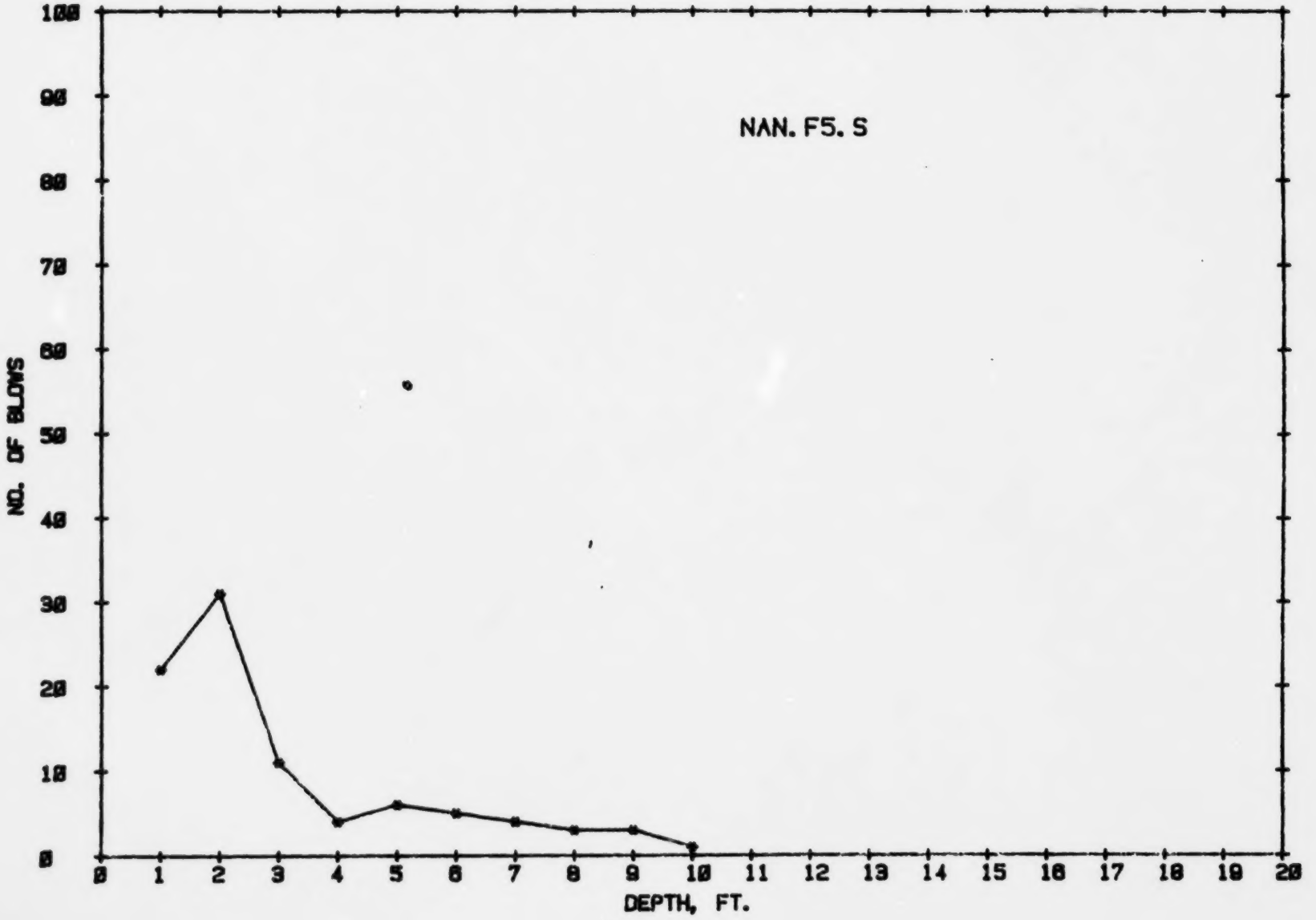
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. F5. S
NO. OF BLOWS
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40
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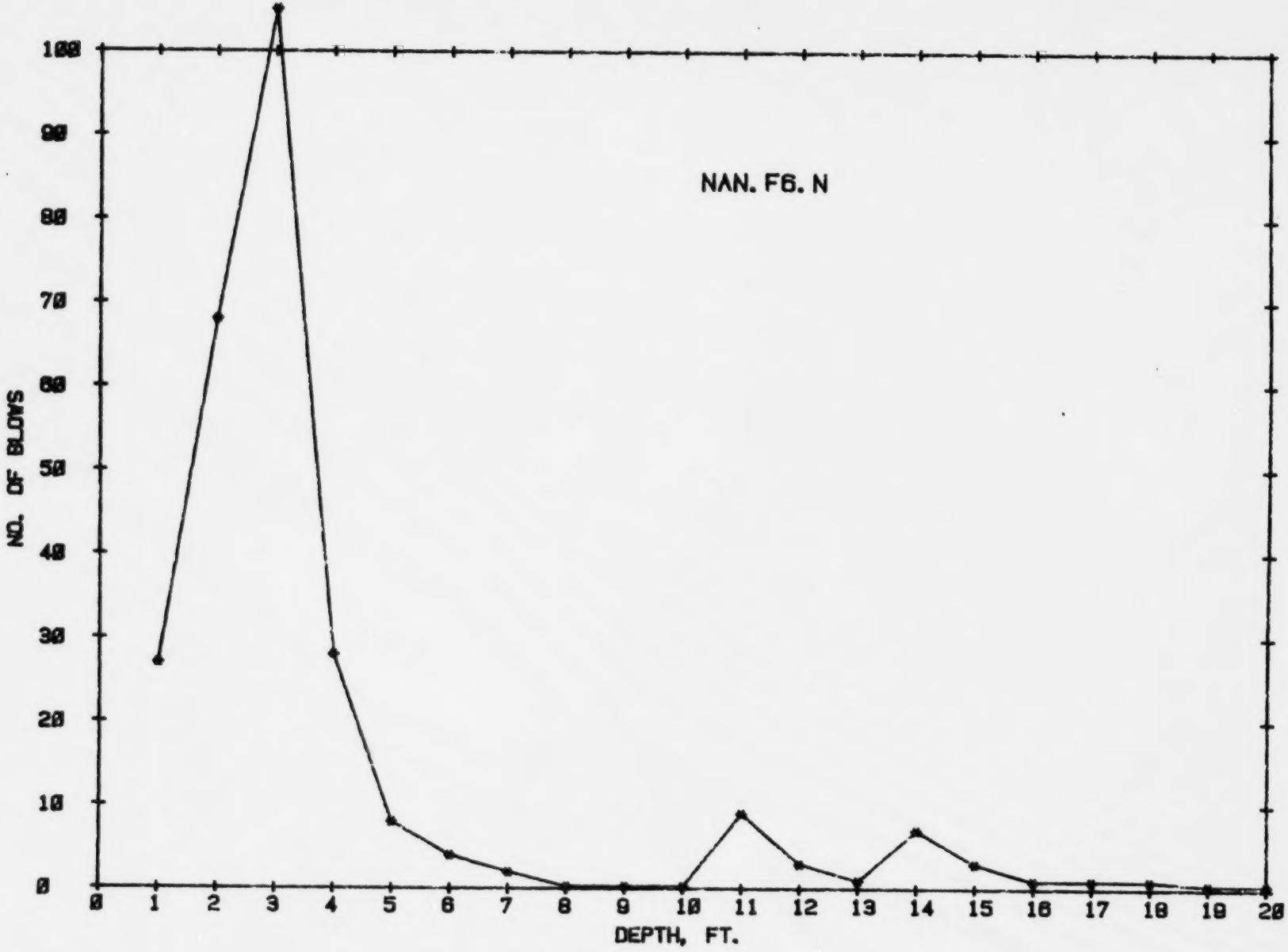
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. F6. N
NO. OF BLOWS
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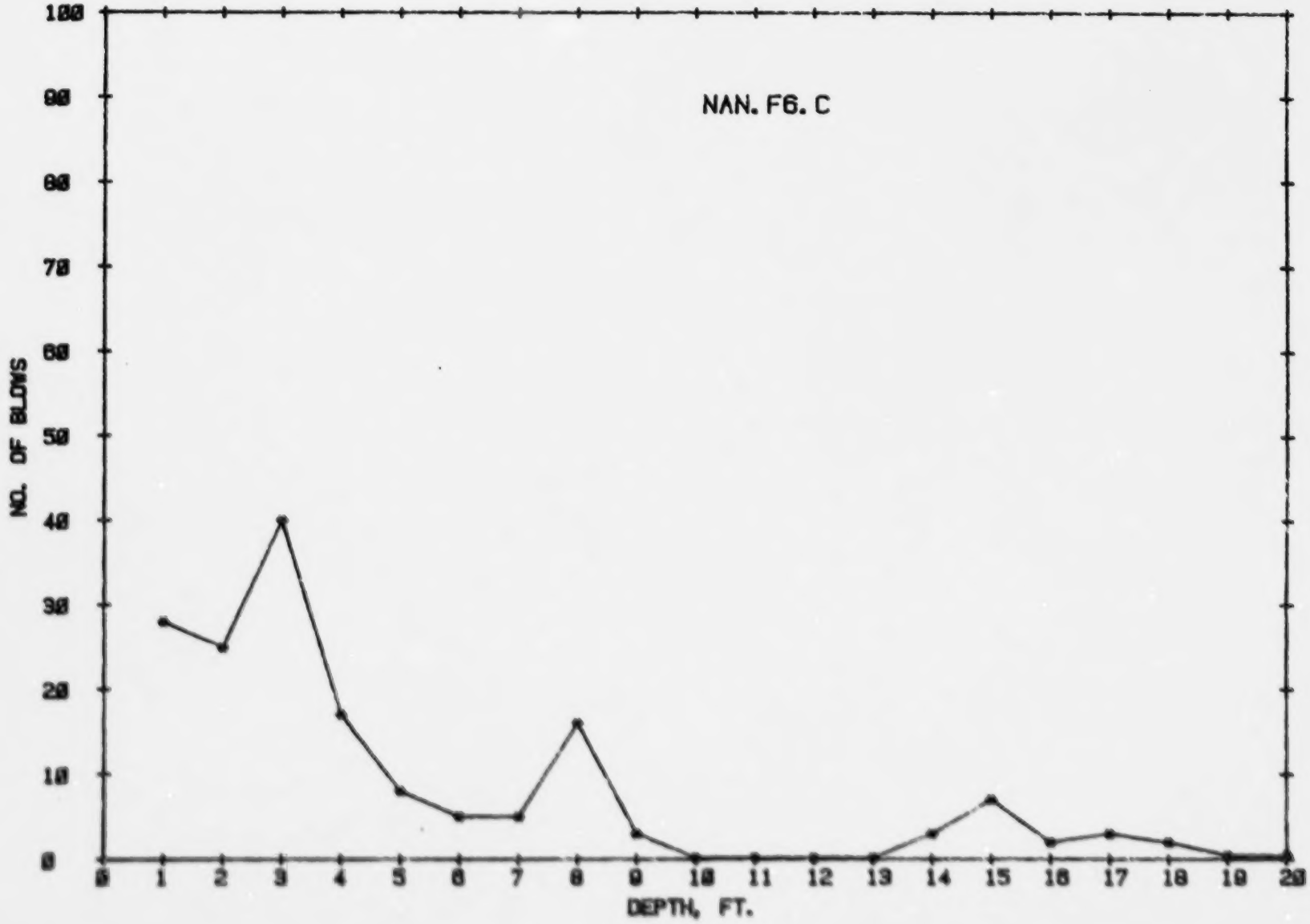
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. F6. C
NO. OF BLOWS
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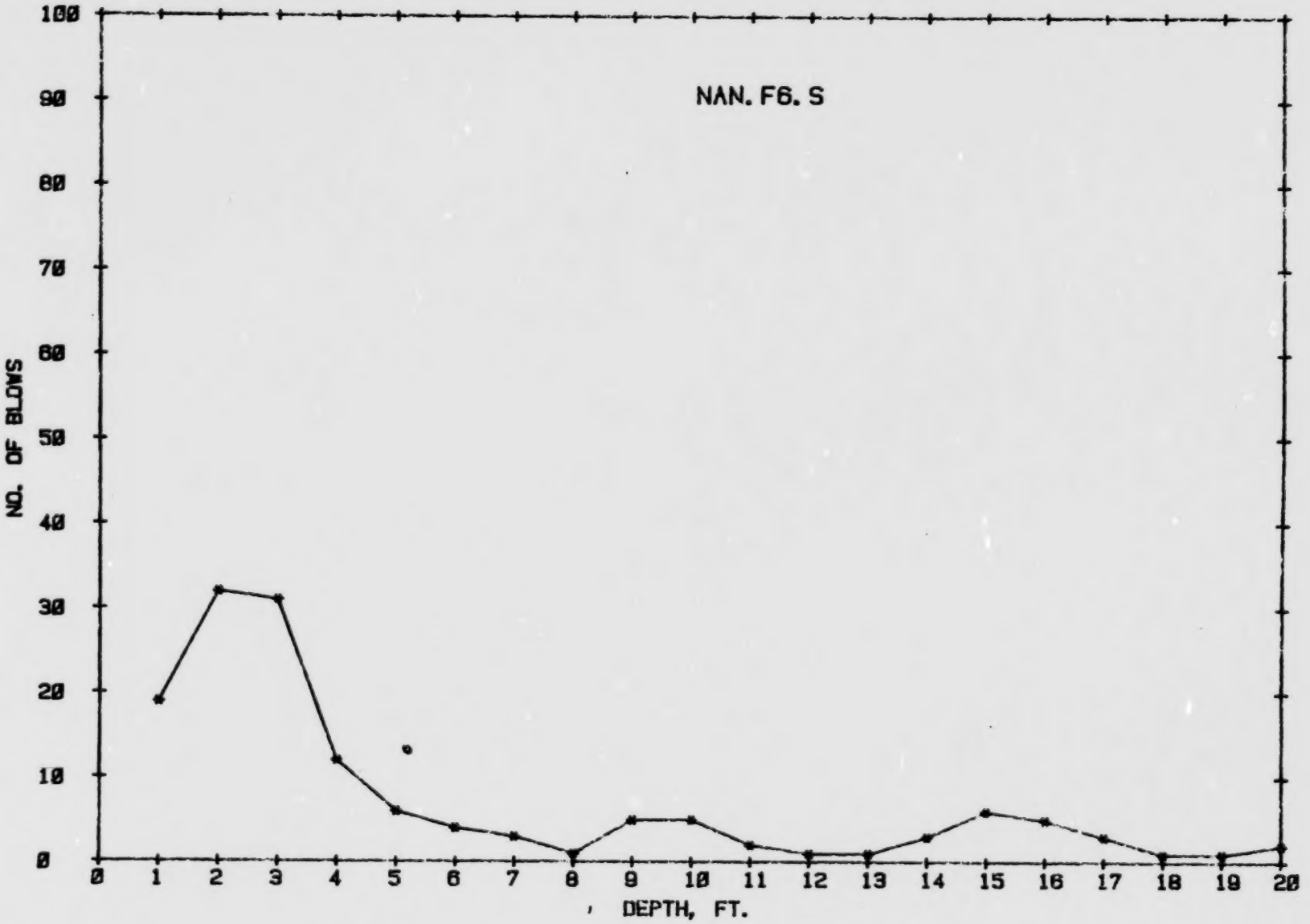
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. F6. S
NO. OF BLOWS
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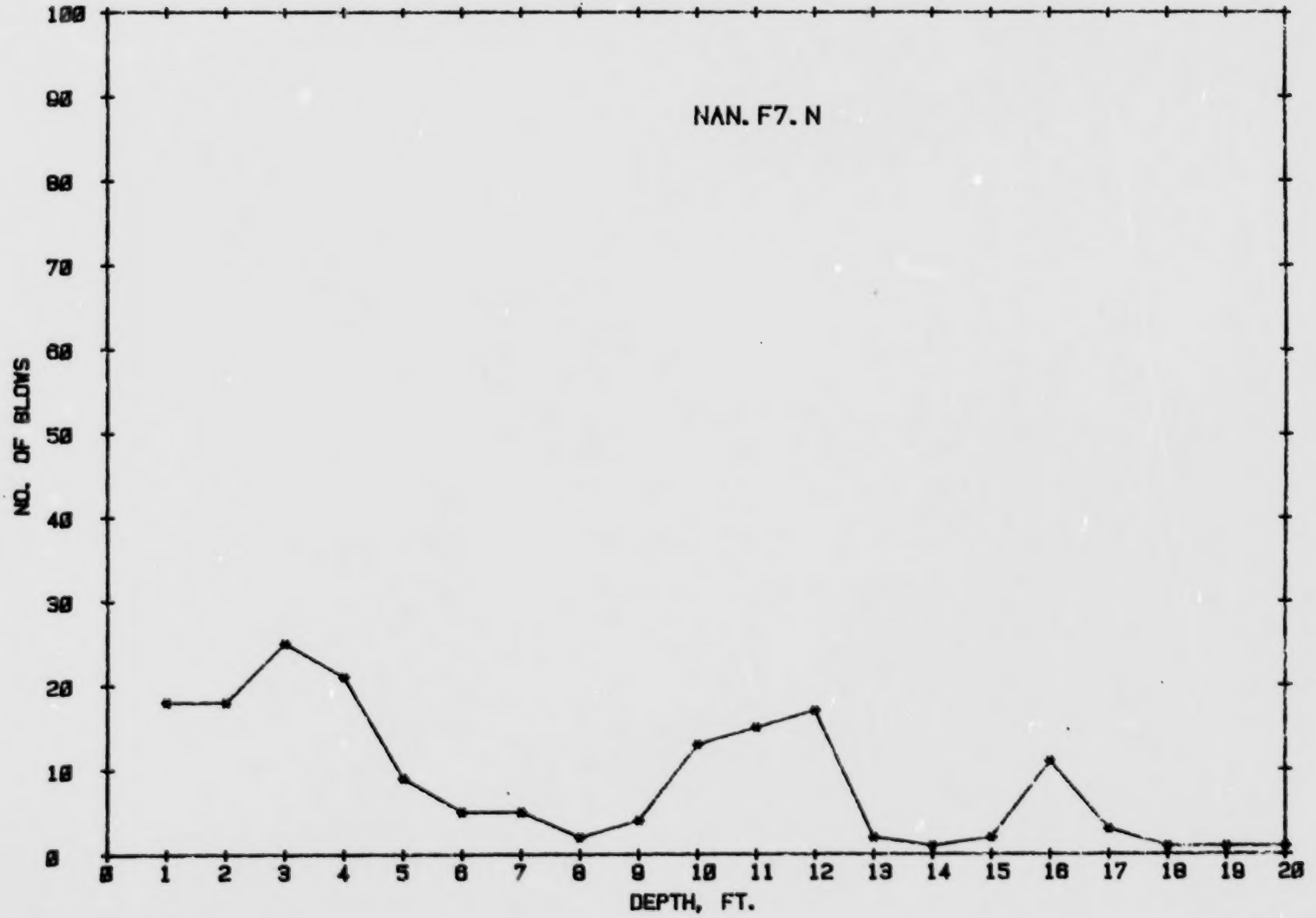
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. F7. N
NO. OF BLOWS
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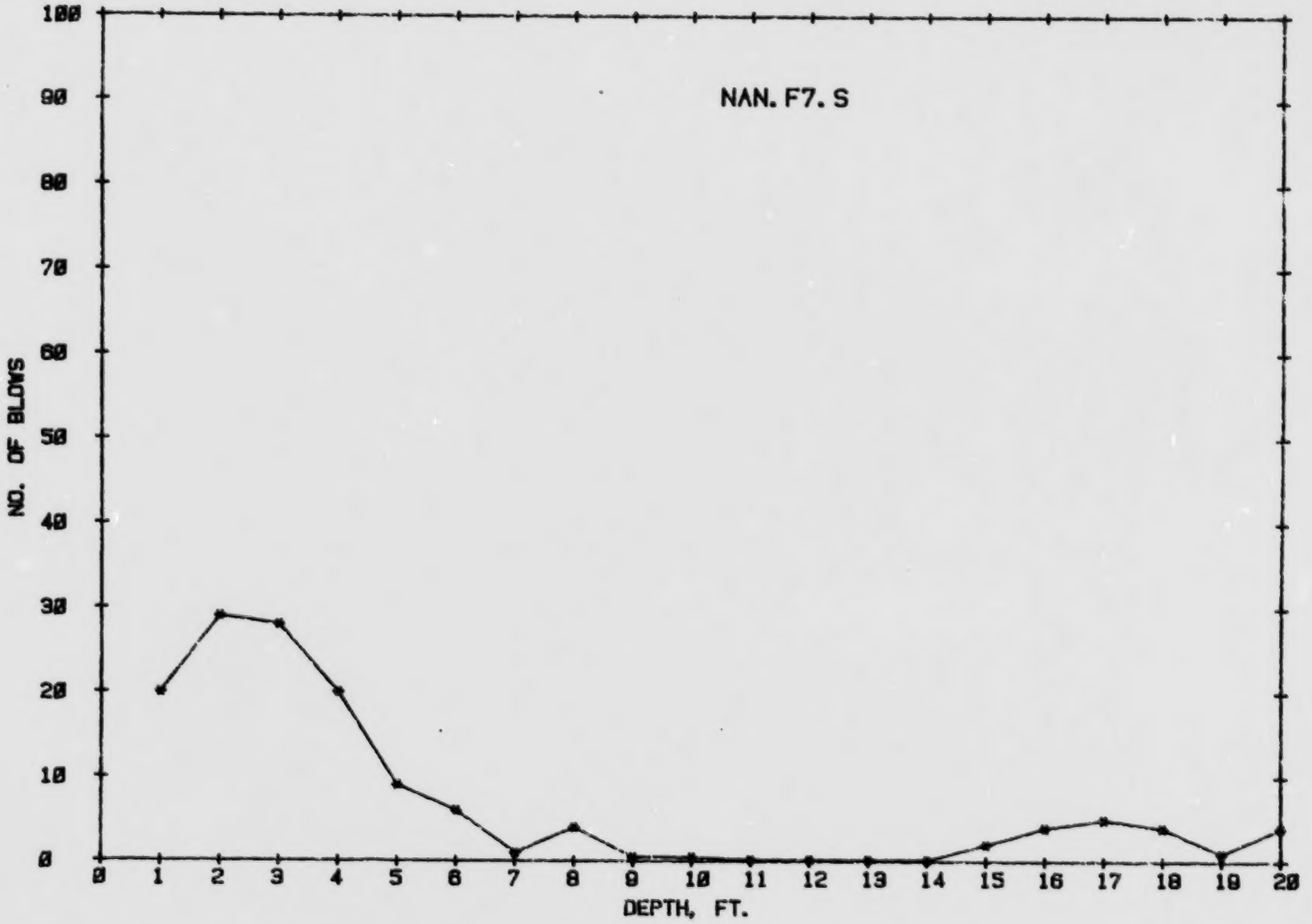
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. F7. S
NO. OF BLOWS
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10
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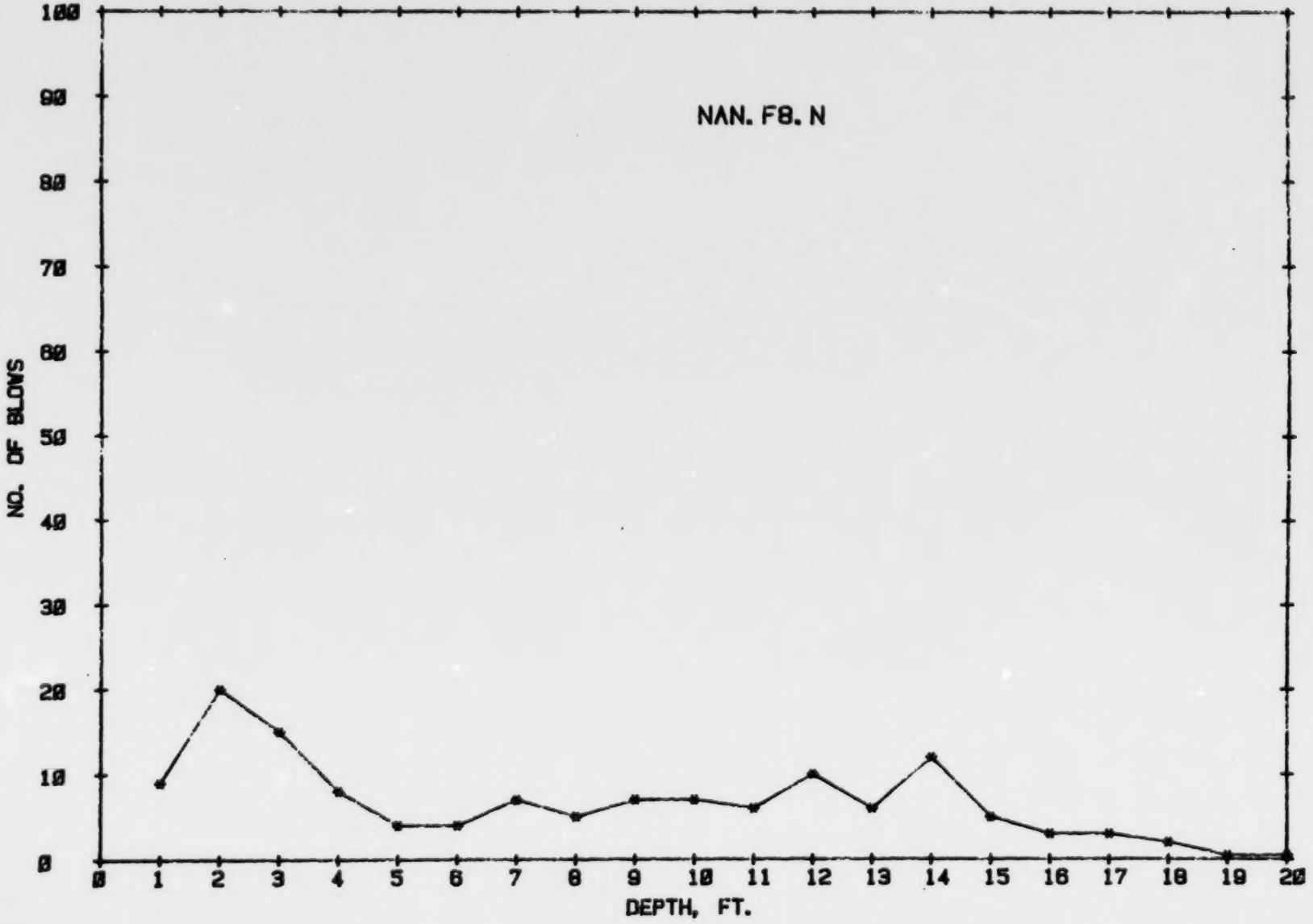
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. F8. N
NO. OF BLOWS
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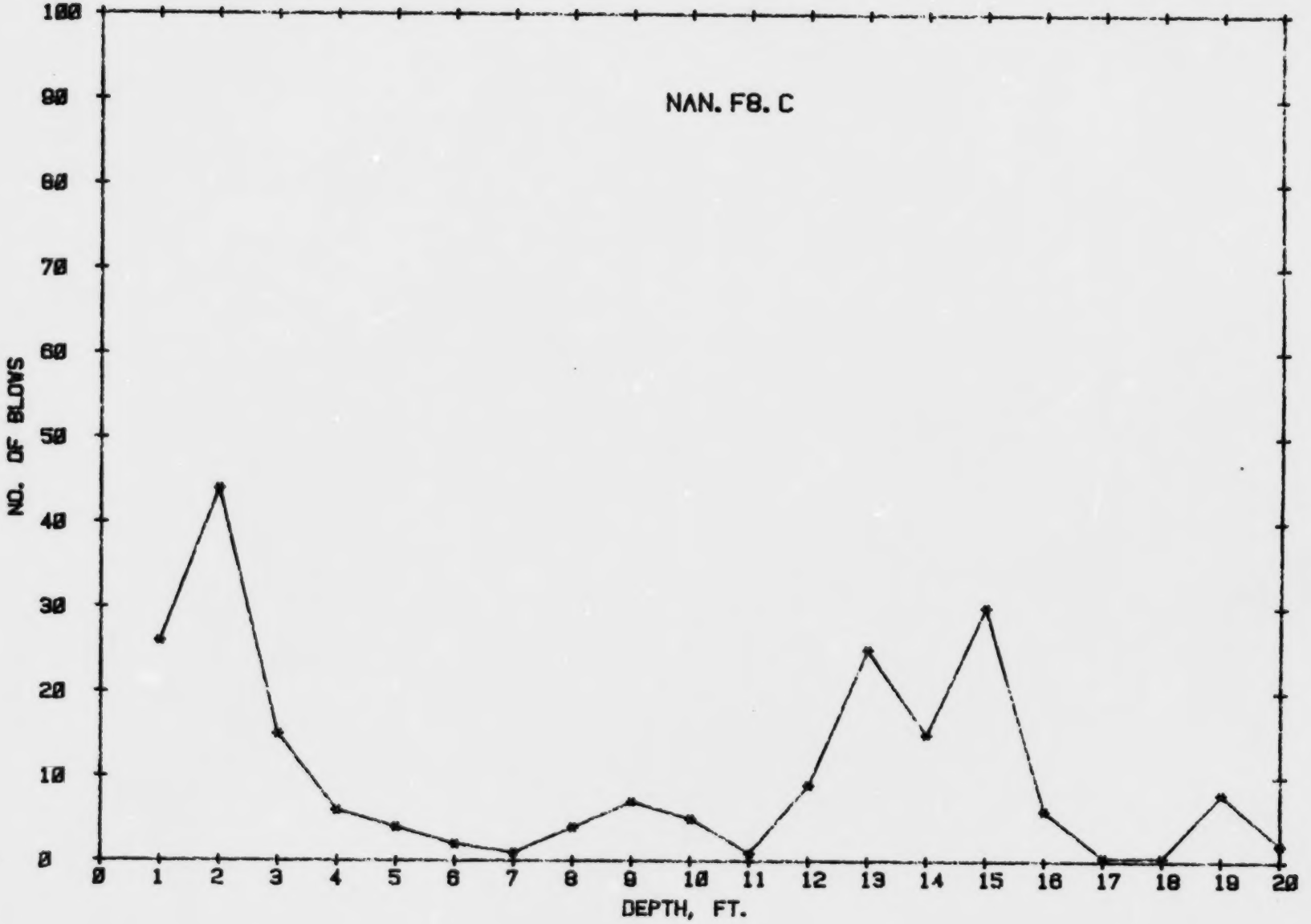
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. F8. C
NO. OF BLOWS
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10
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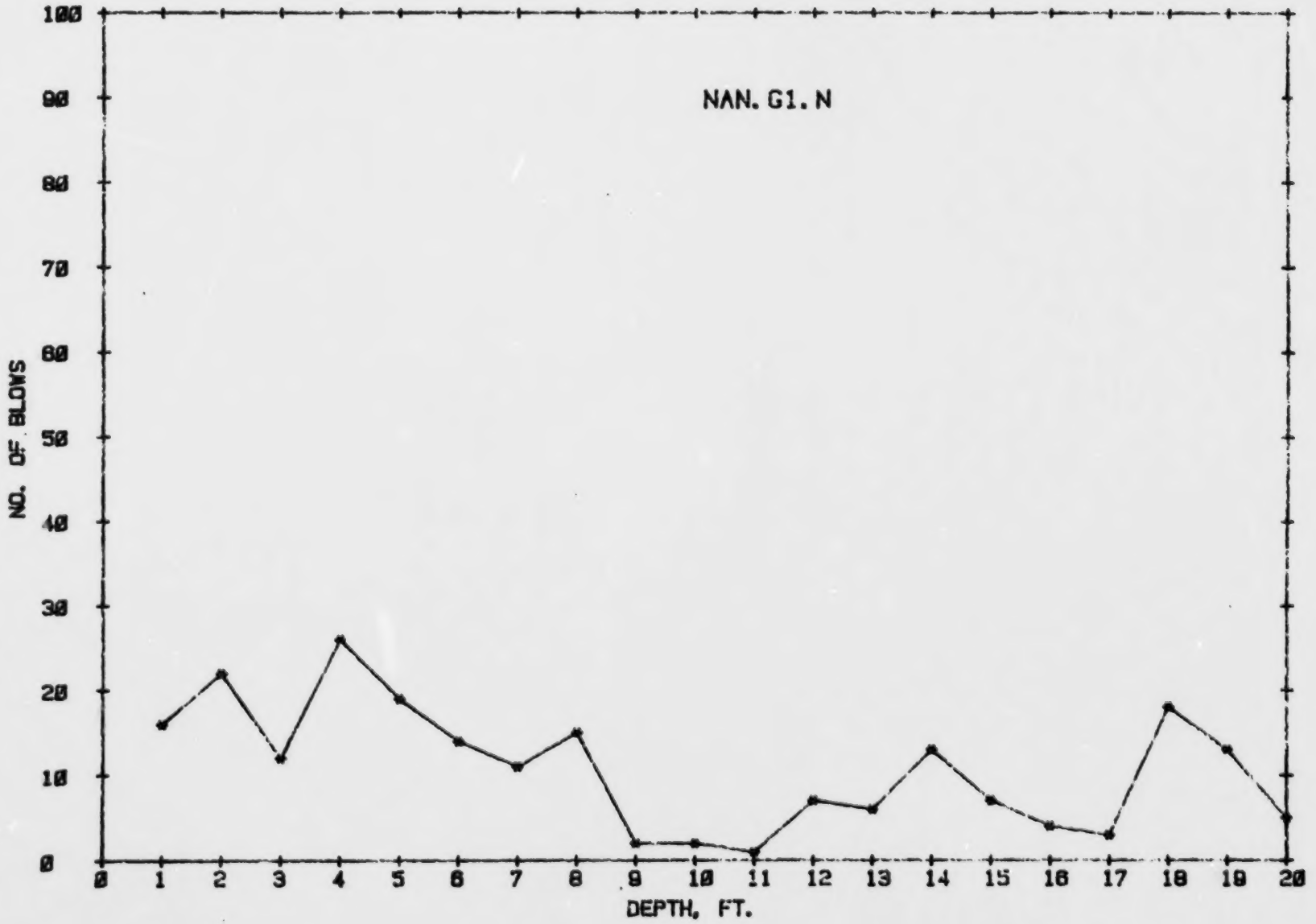
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. G1. N
NO. OF BLOWS
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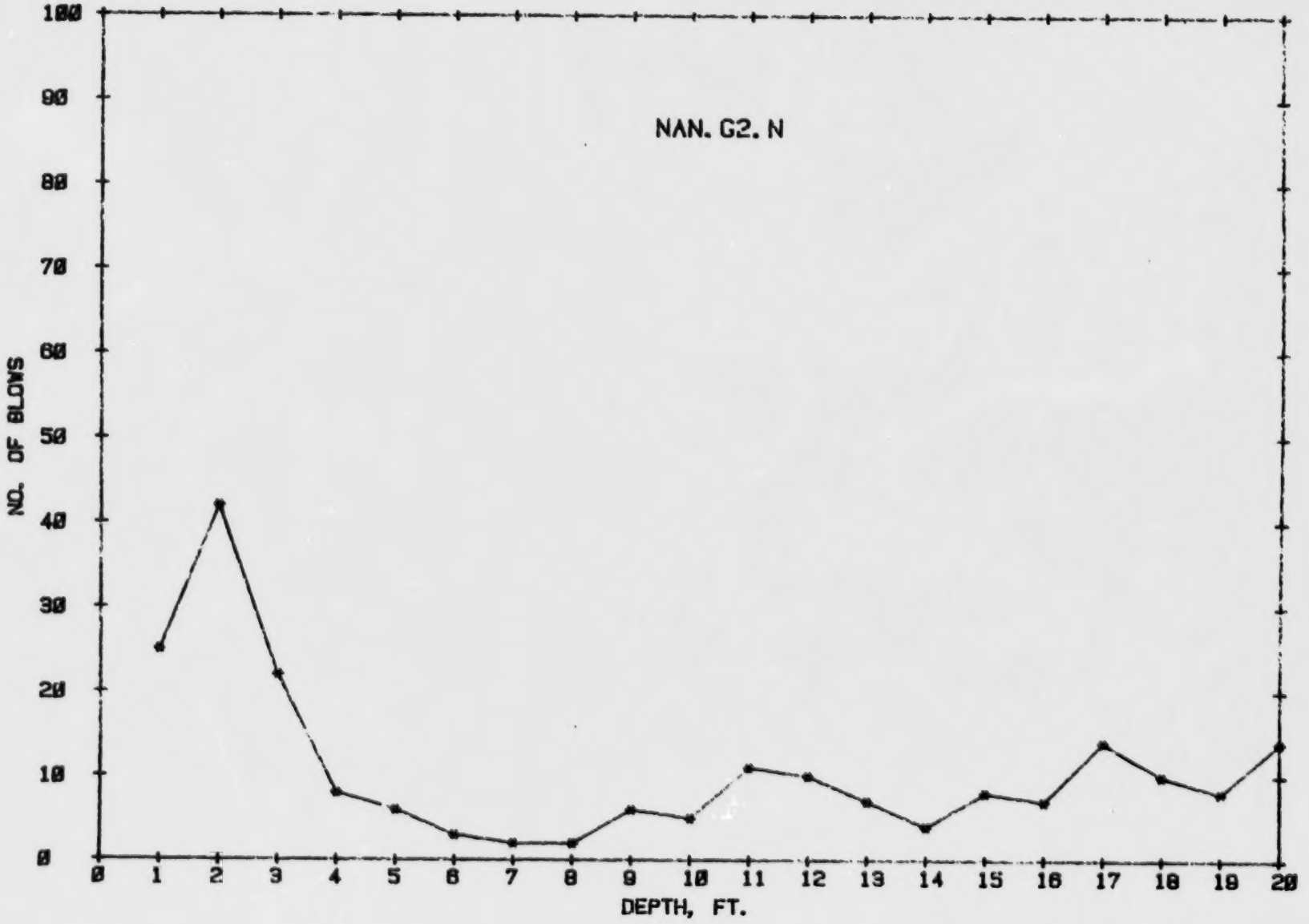
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. G2. N
NO. OF BLOWS
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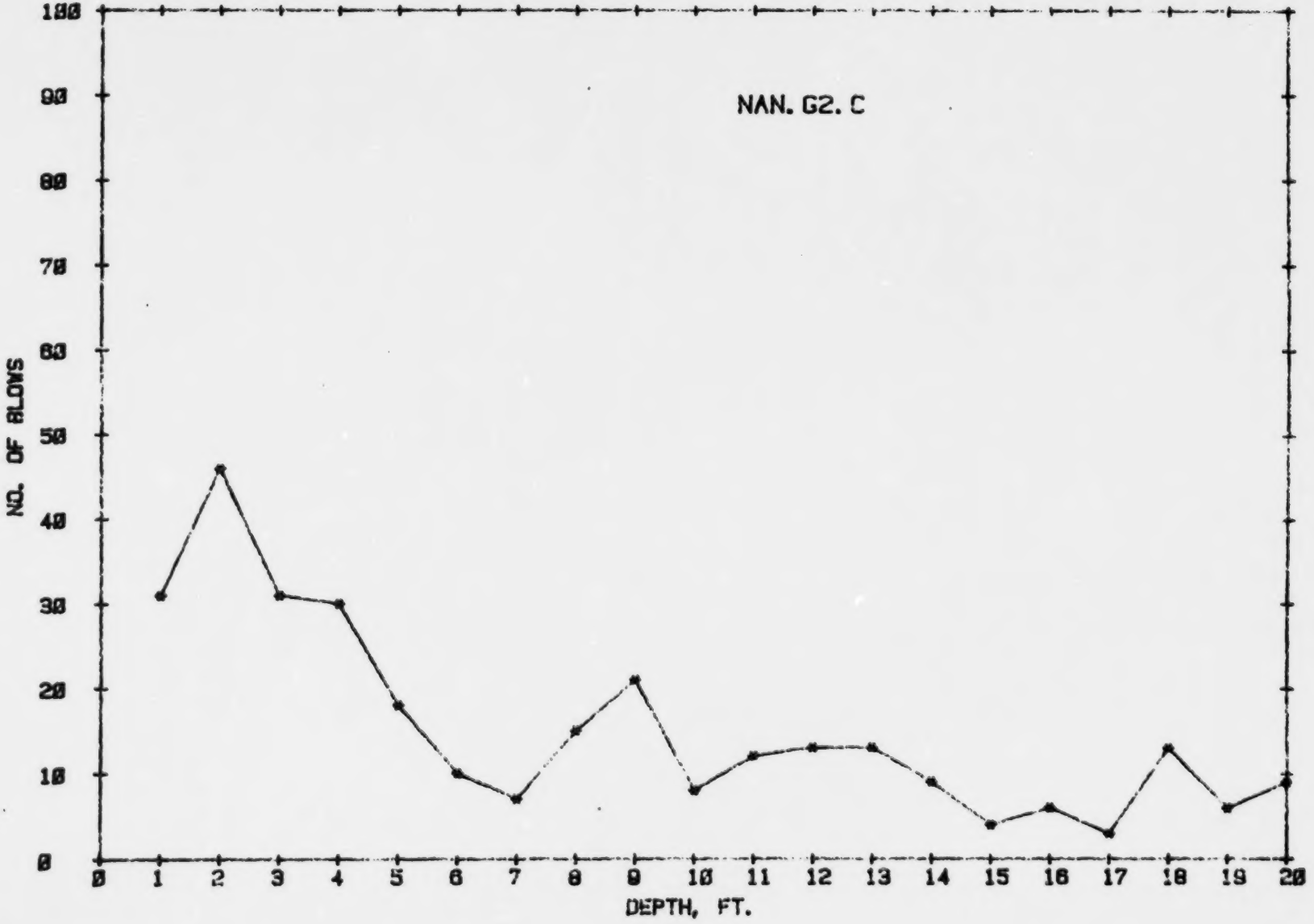
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. G2. C
NO. OF BLOWS
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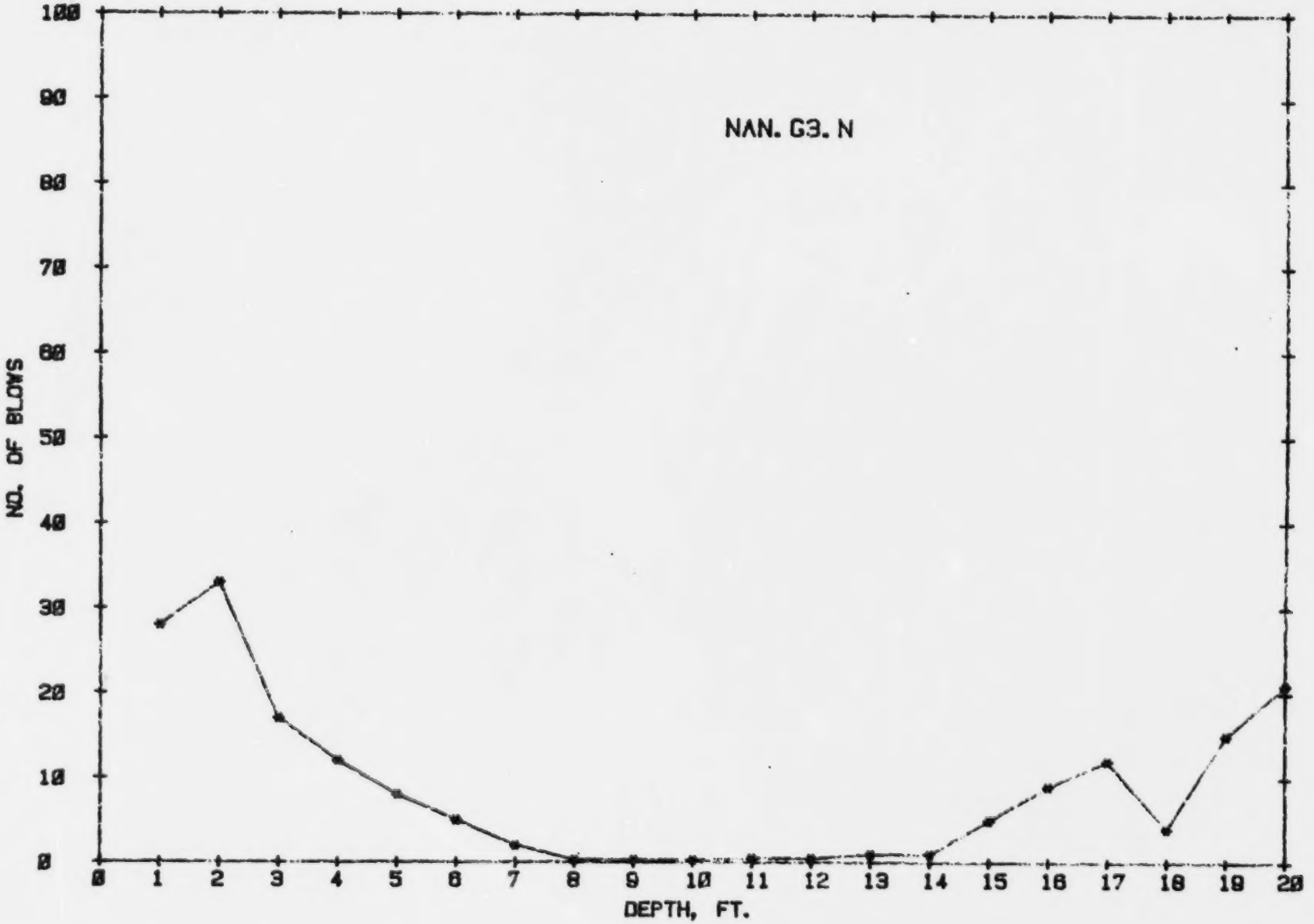
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. G3. N
NO. OF BLOWS
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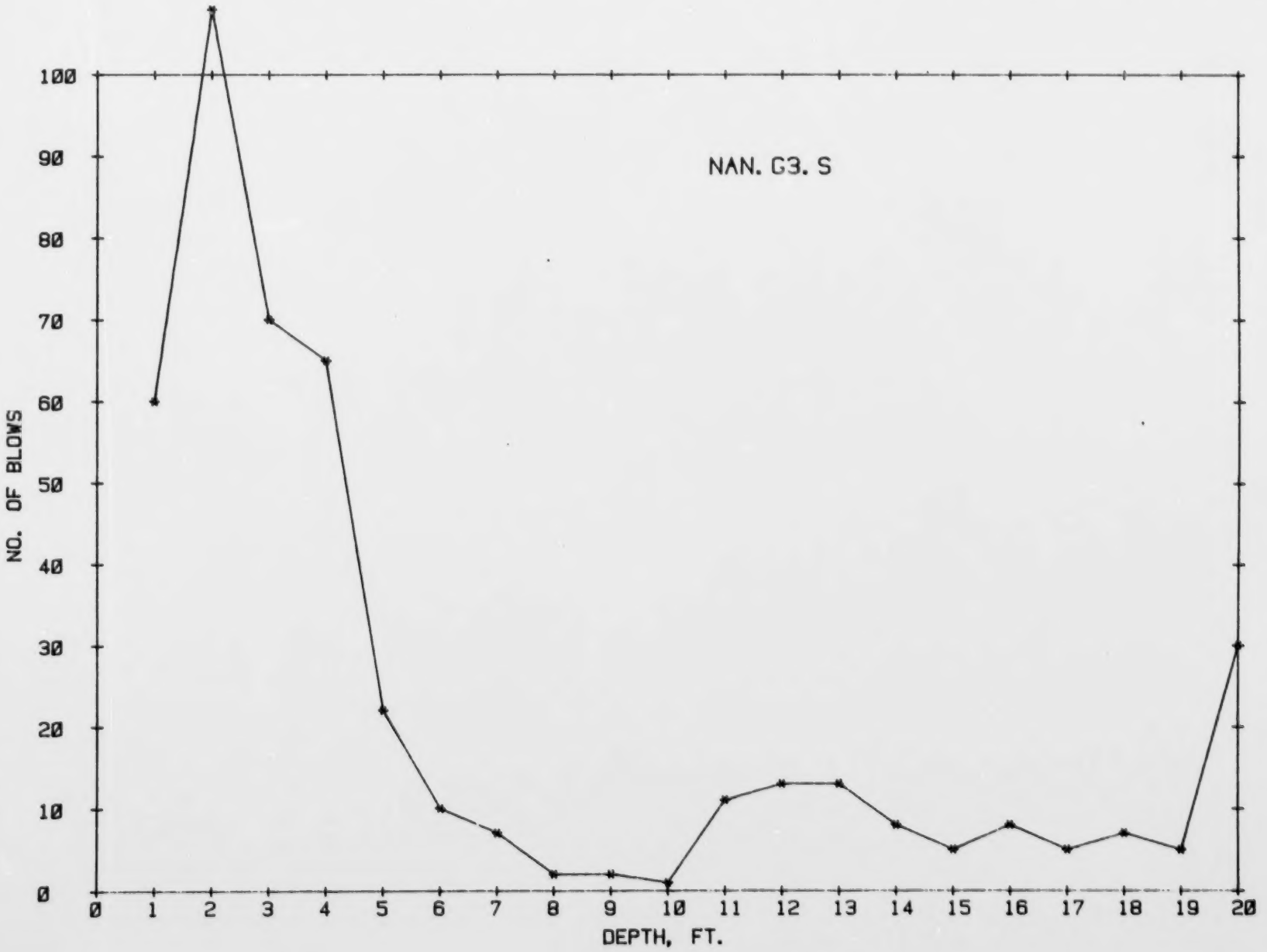
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. G3. S
NO. OF BLOWS
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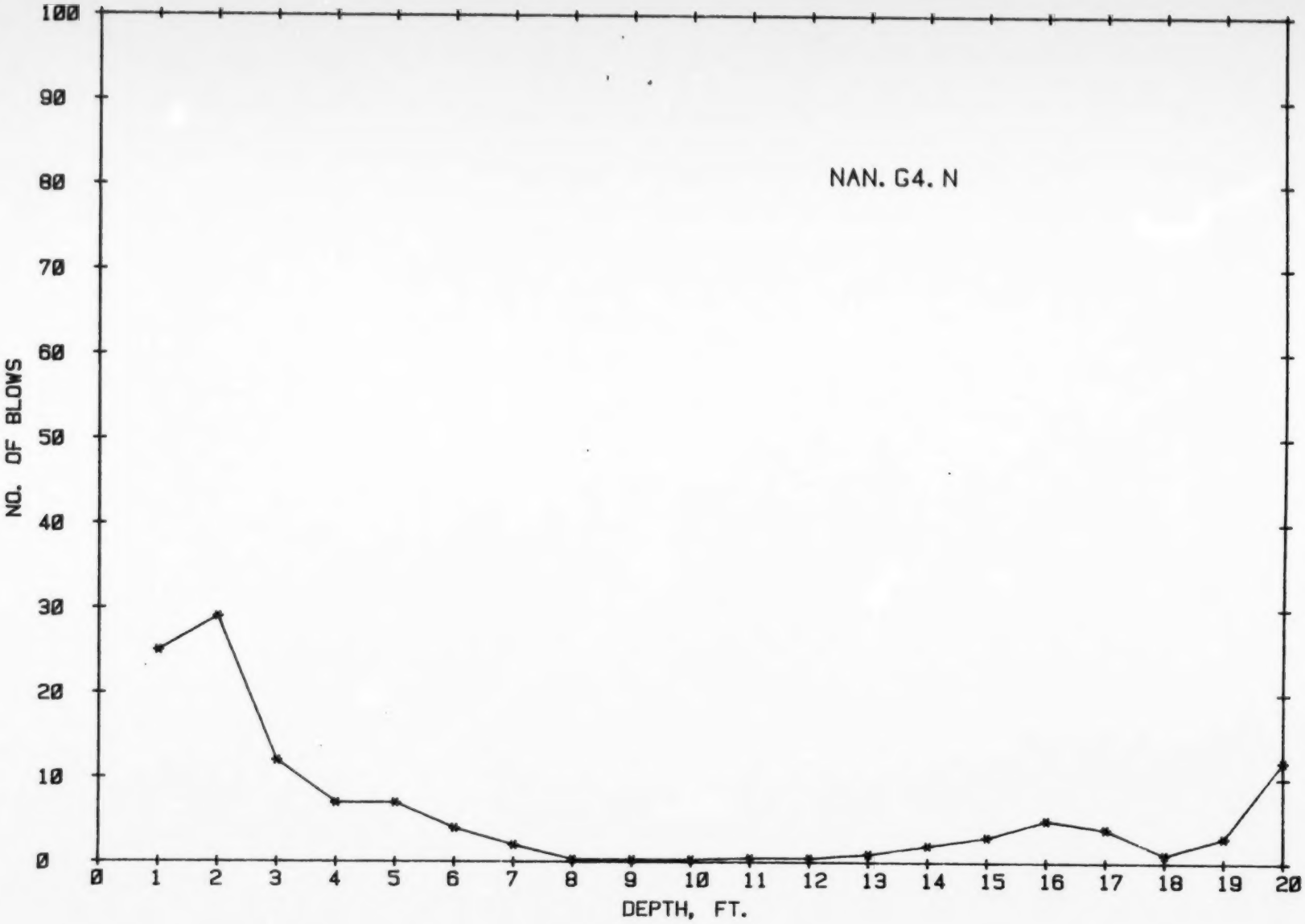
80
90
100
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. G4. N
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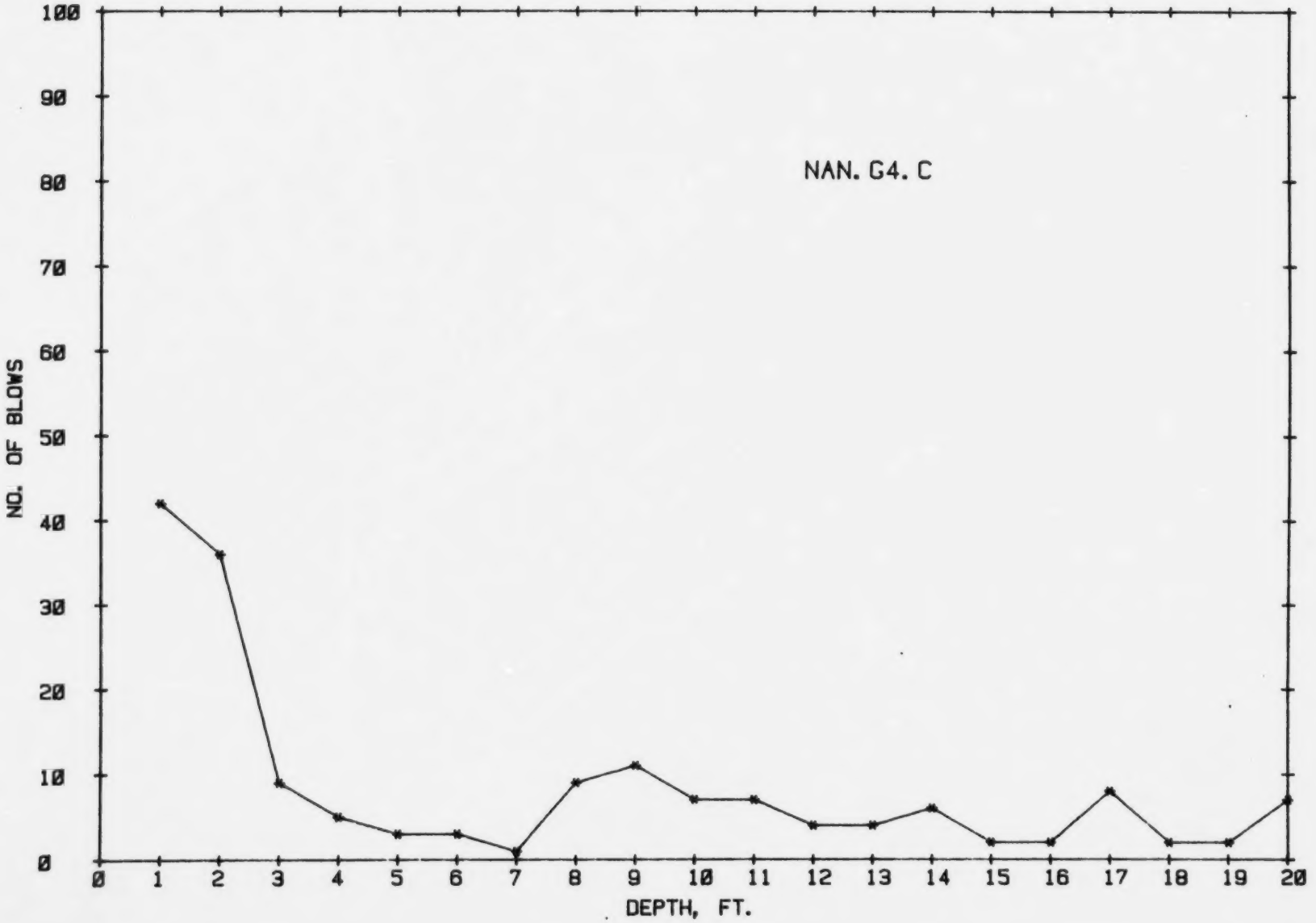
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. G4. C
NO. OF BLOWS
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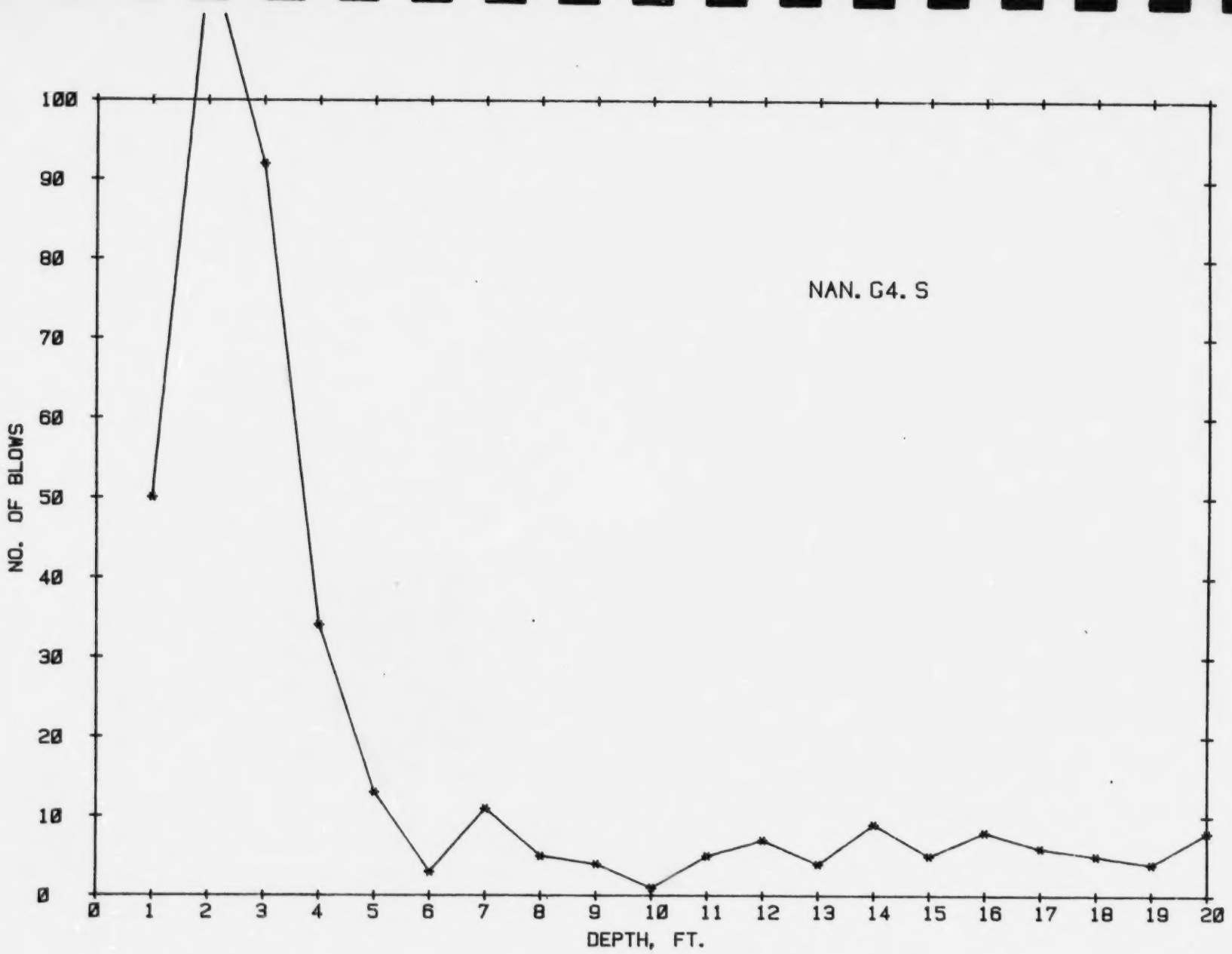
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. G4. S
NO. OF BLOWS
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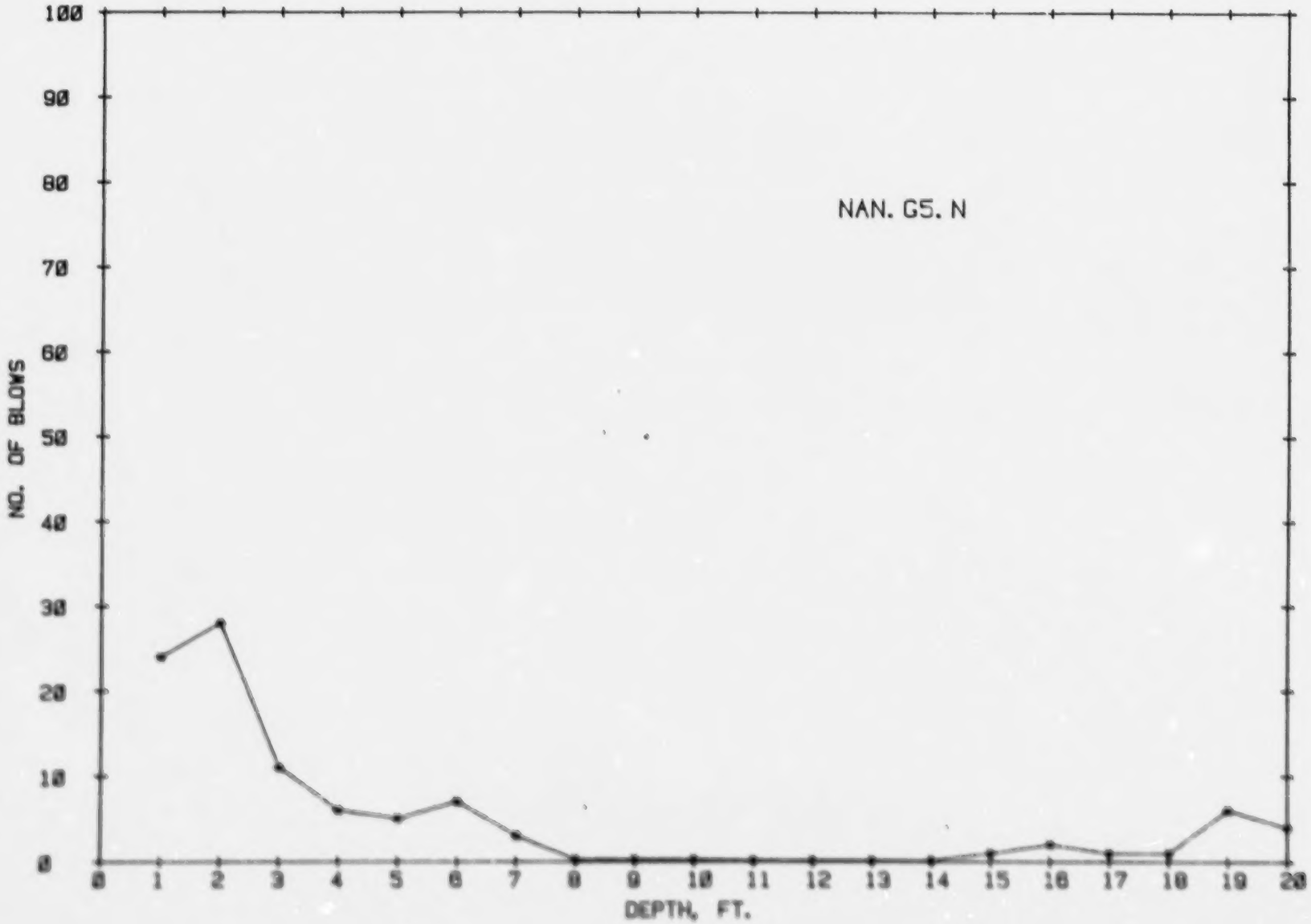
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. G5. N
NO. OF BLOWS
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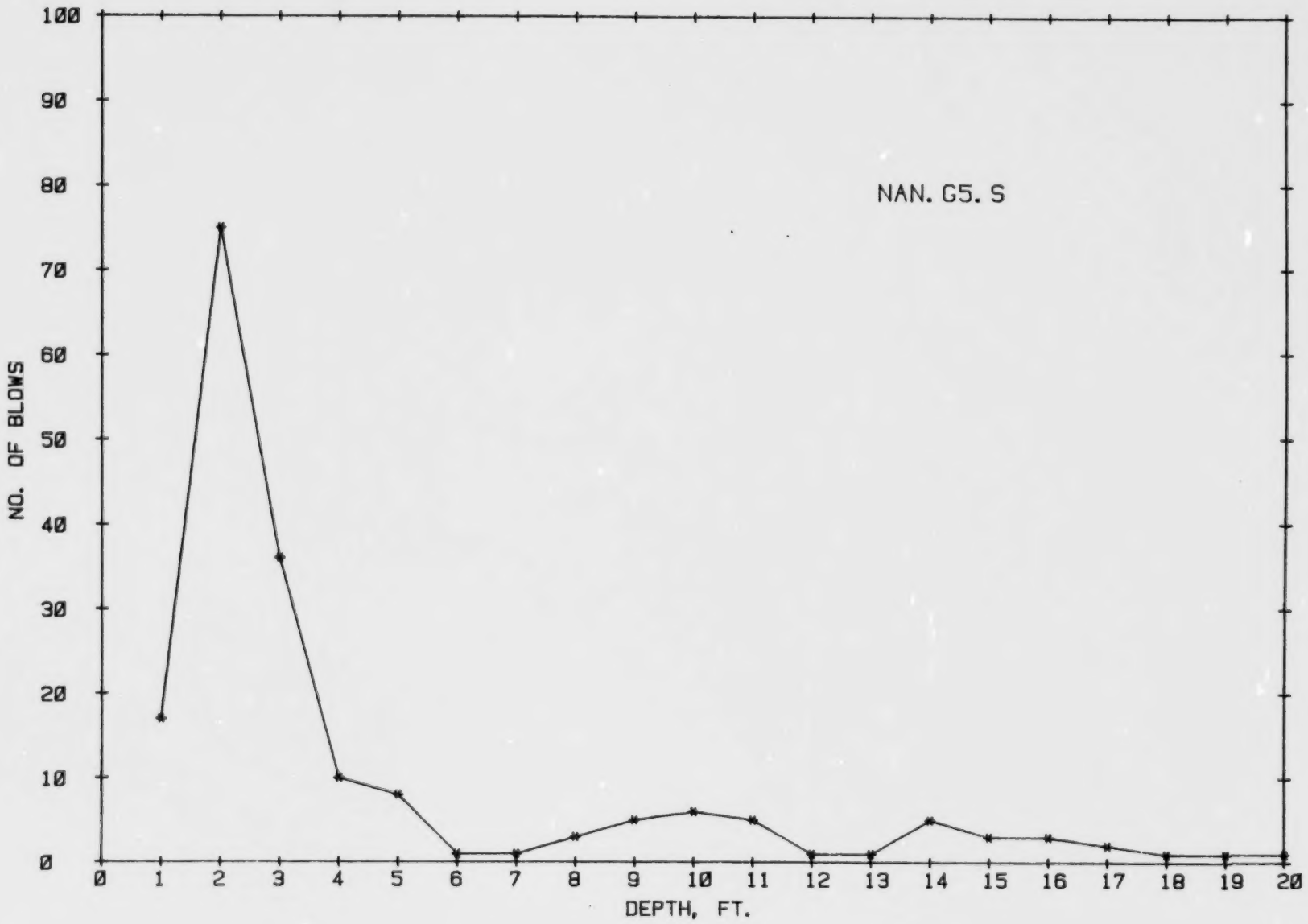
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. G5. S
NO. OF BLOWS
DEPTH, FT.
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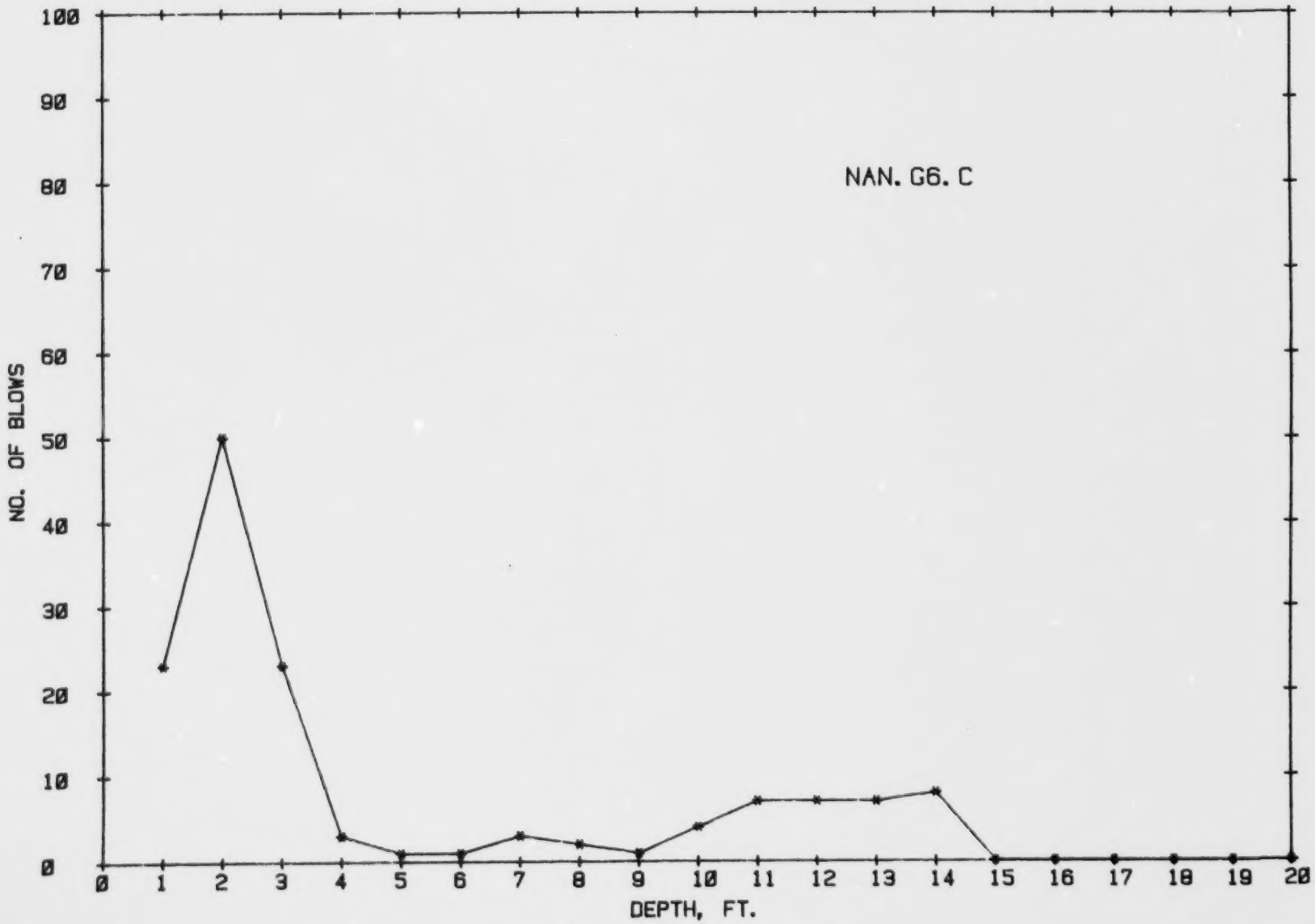
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20


NAN. G6. C
NO. OF BLOWS
DEPTH, FT.
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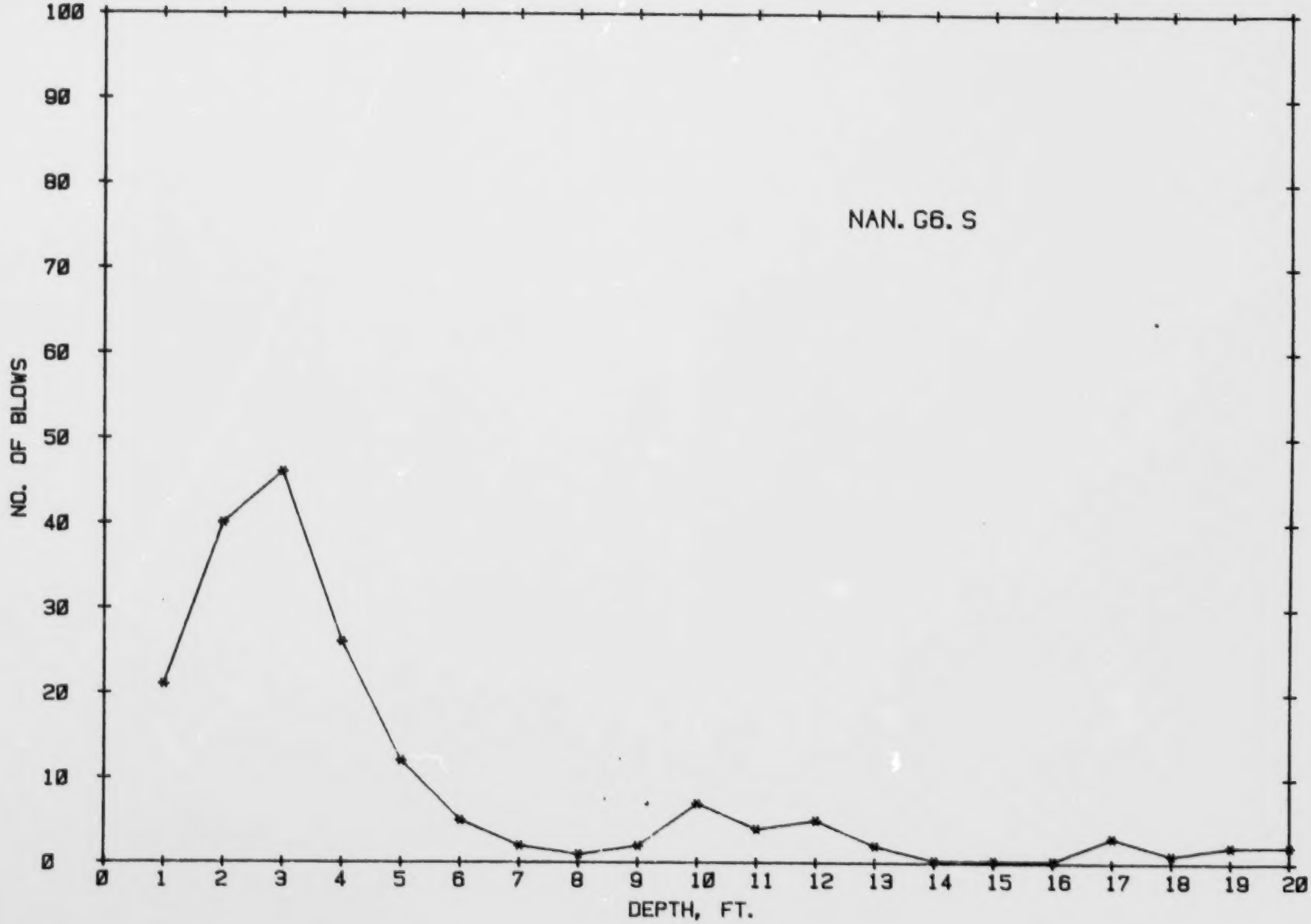
NAN. G6. S
NO. OF BLOWS
DEPTH, FT.
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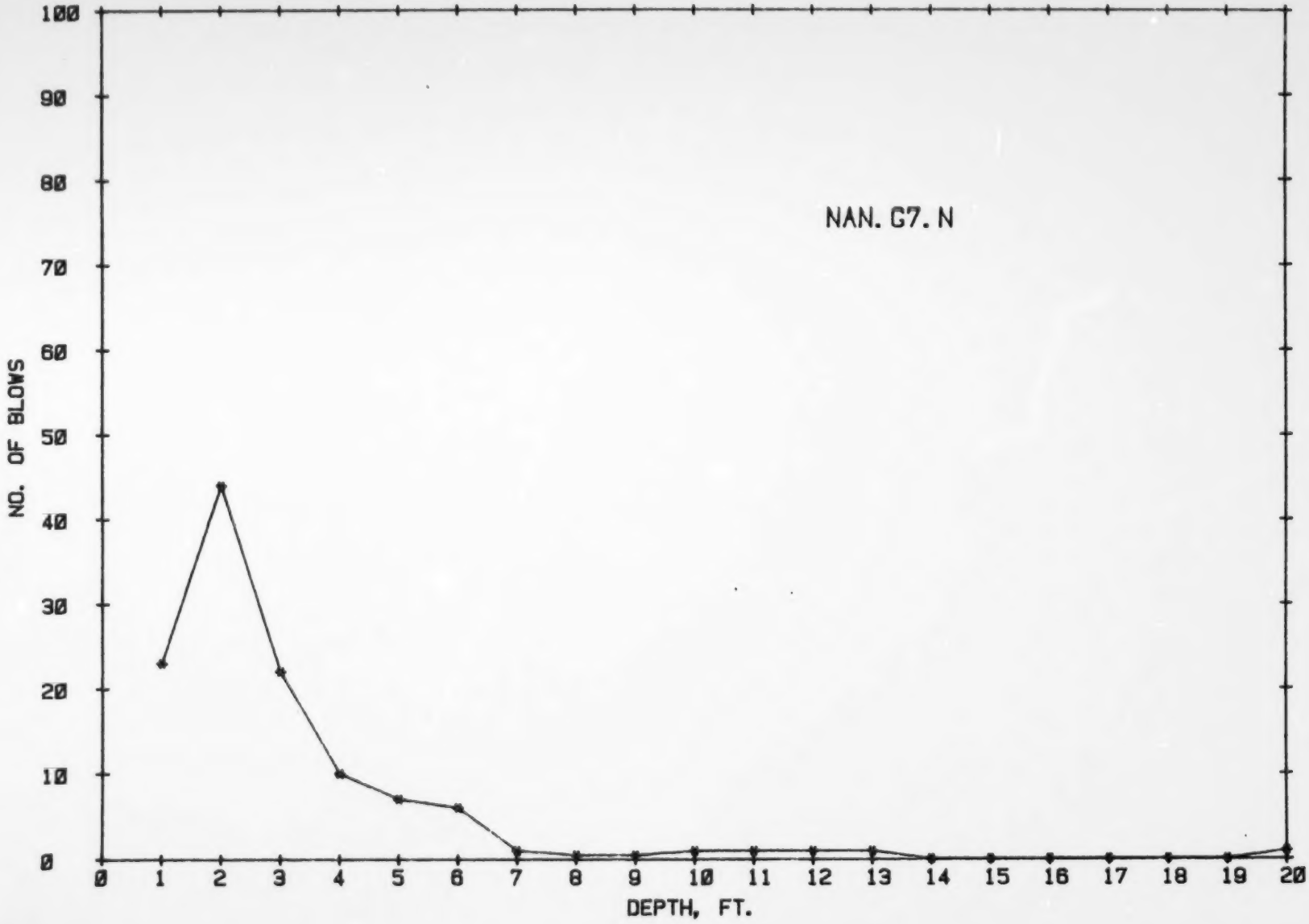
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20


NAN. G7. N
NO. OF BLOWS
DEPTH, FT.
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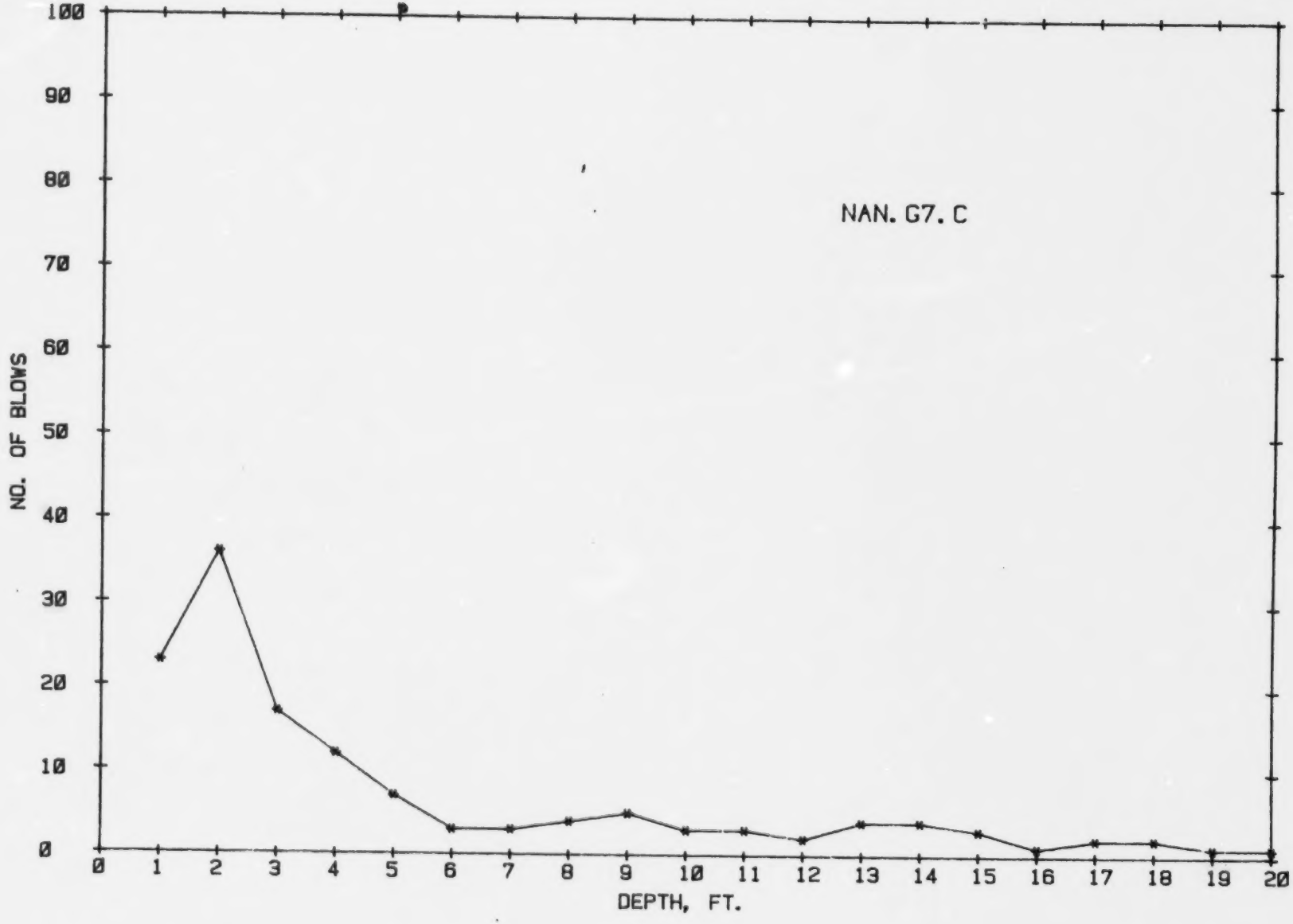
100
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20


NAN. G7. C
NO. OF BLOWS
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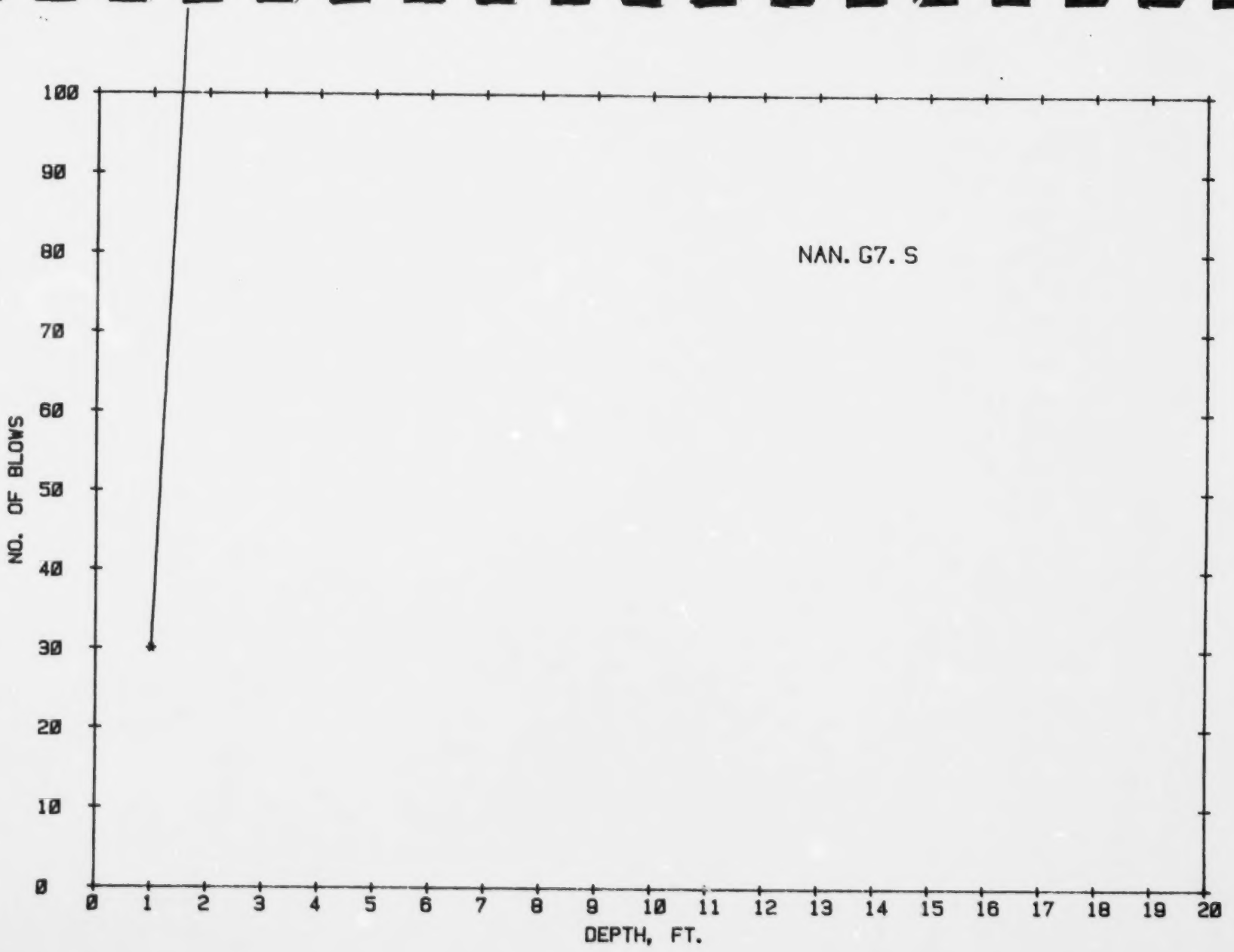
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. G7. S
NO. OF BLOWS
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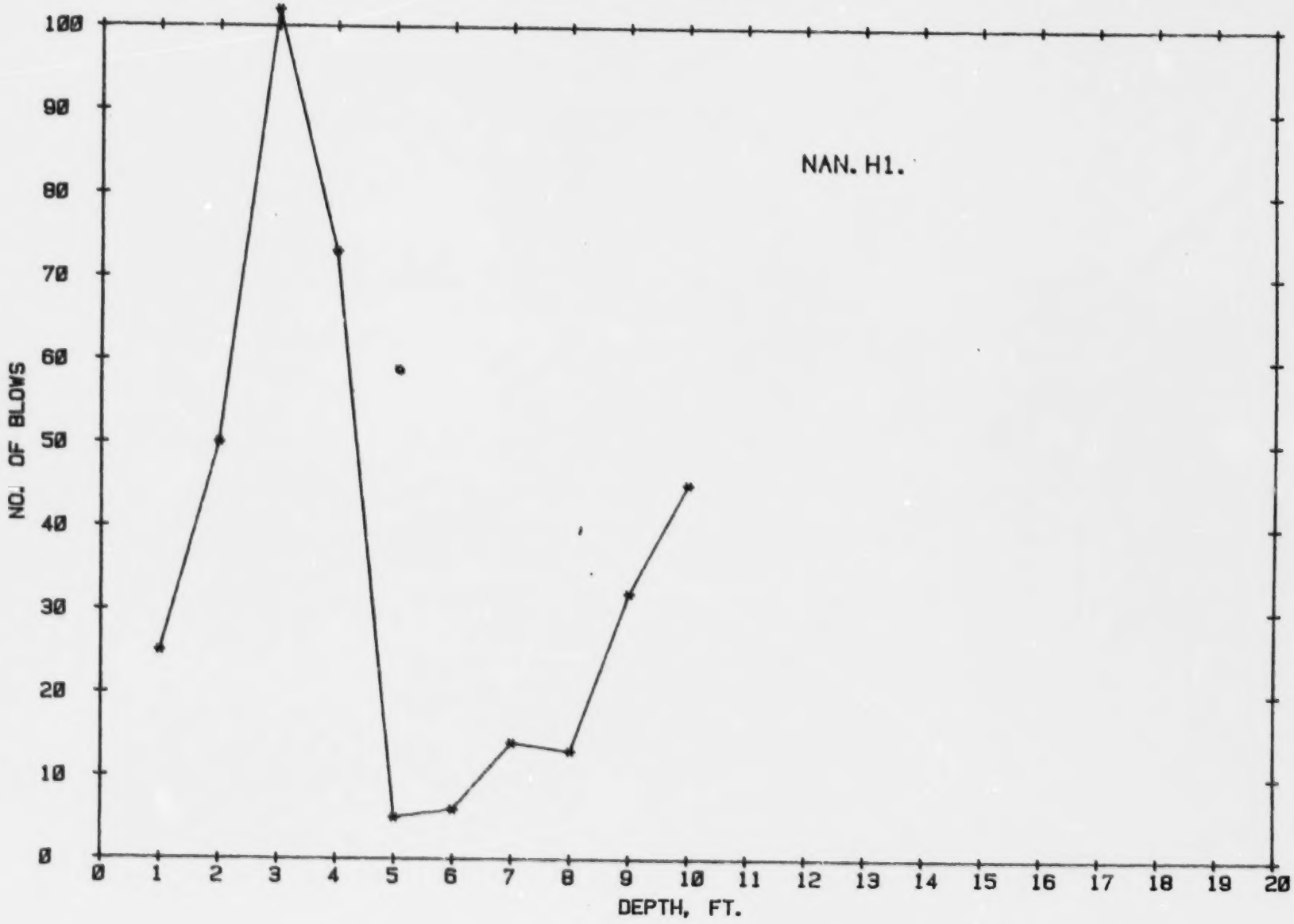
80
90
100
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. H1.
NO. OF BLOWS
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50
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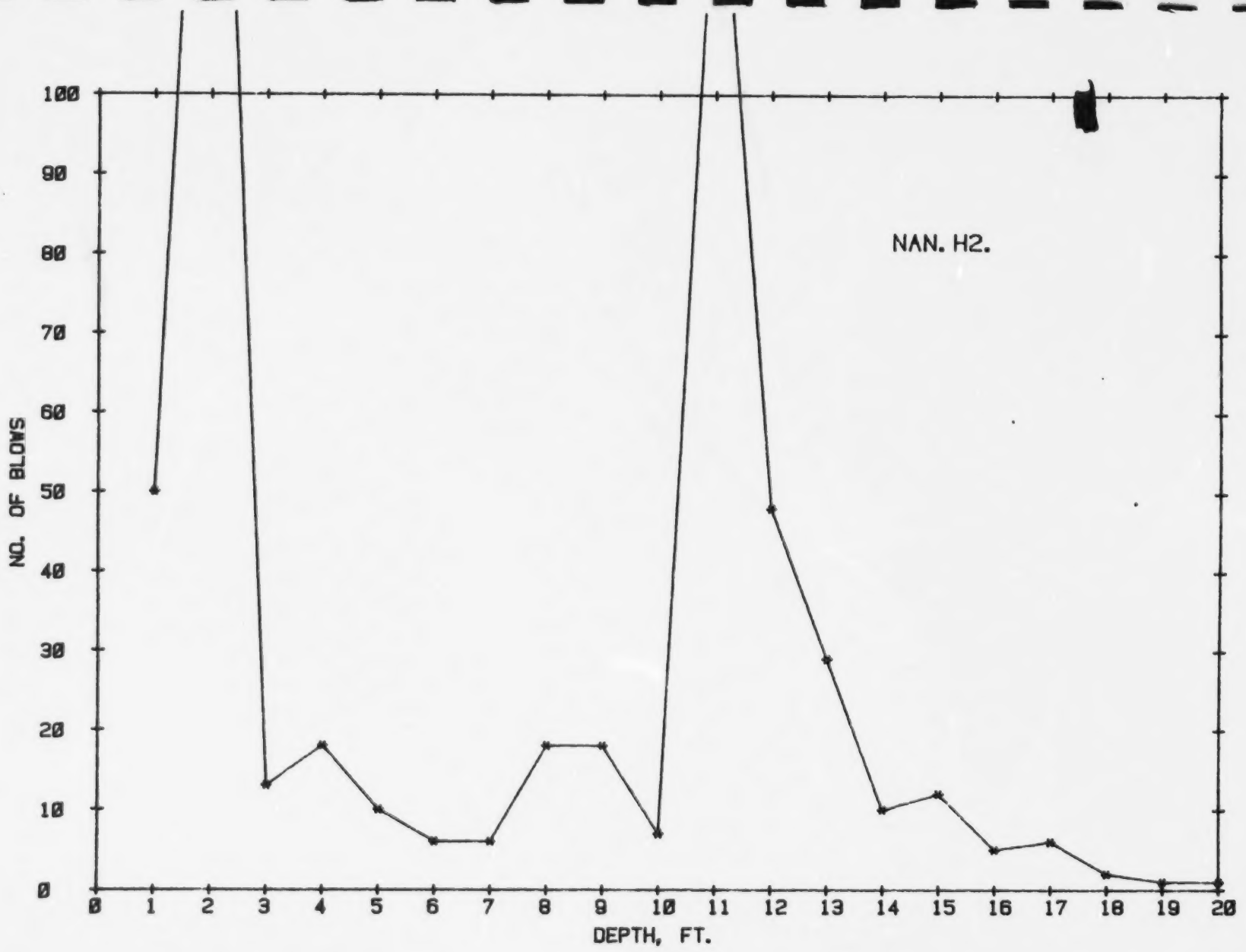
90
100
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. H2.
NO. OF BLOWS
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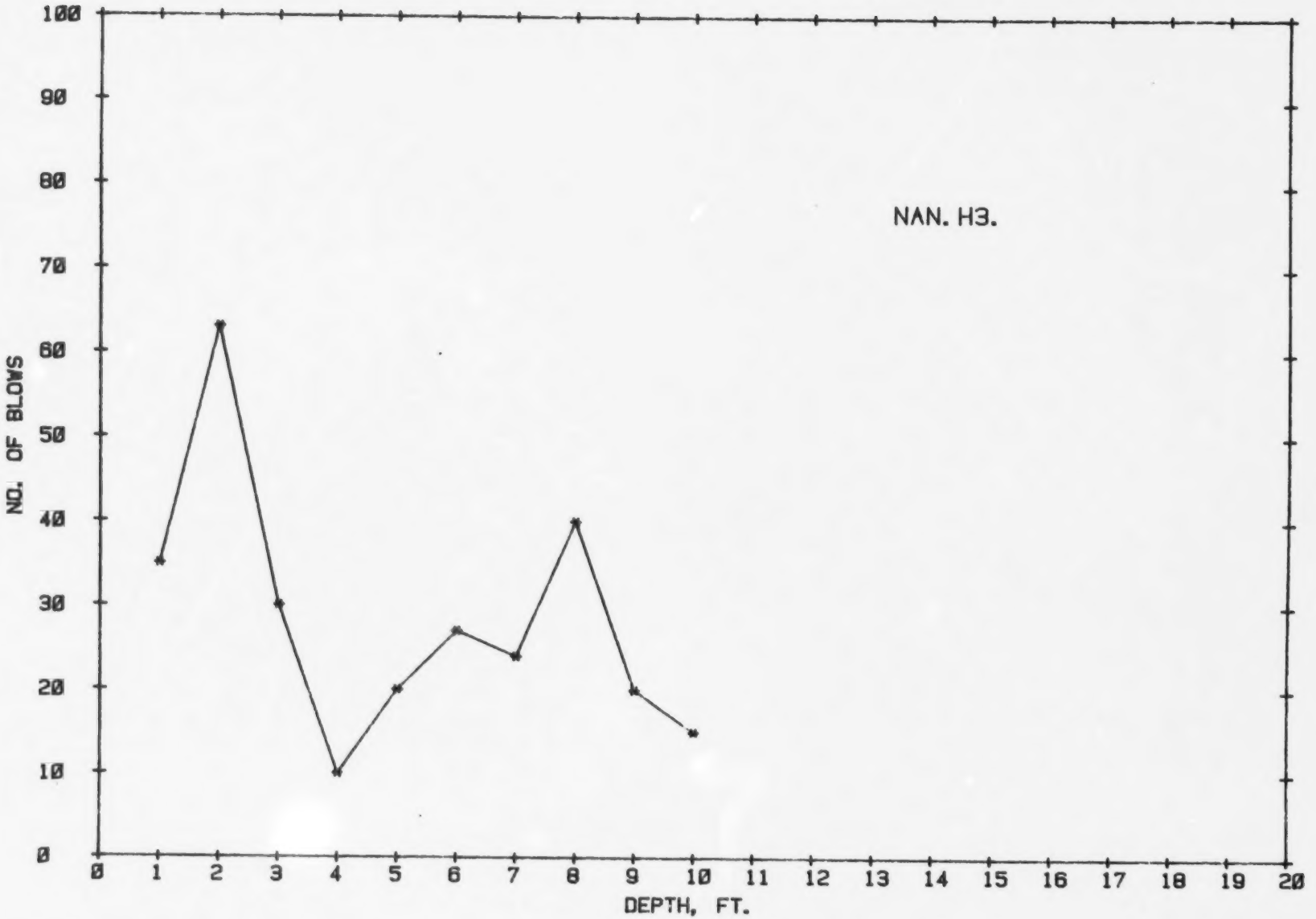
90
100
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. H3.
NO. OF BLOWS
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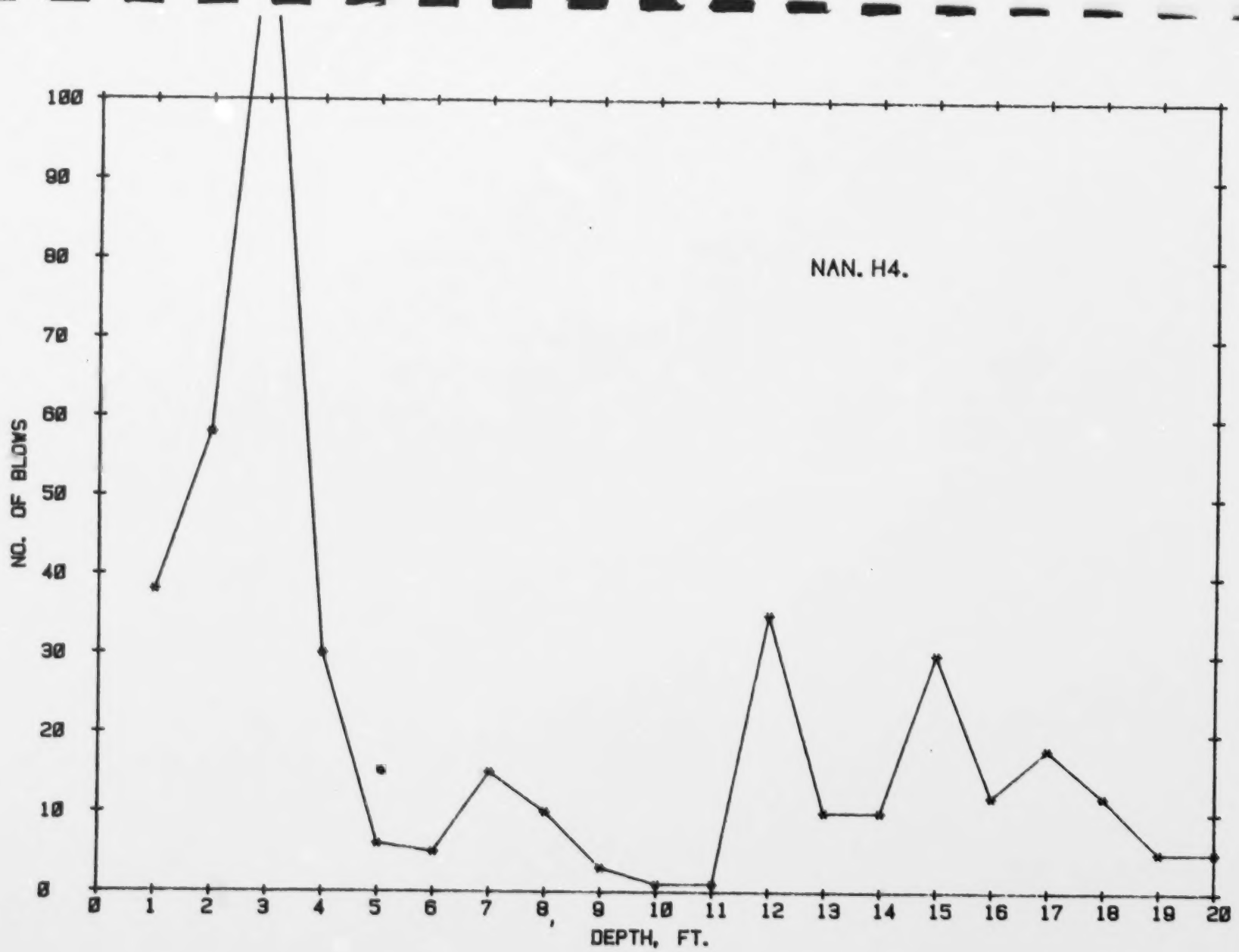
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. H4.
NO. OF BLOWS
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60
70
80
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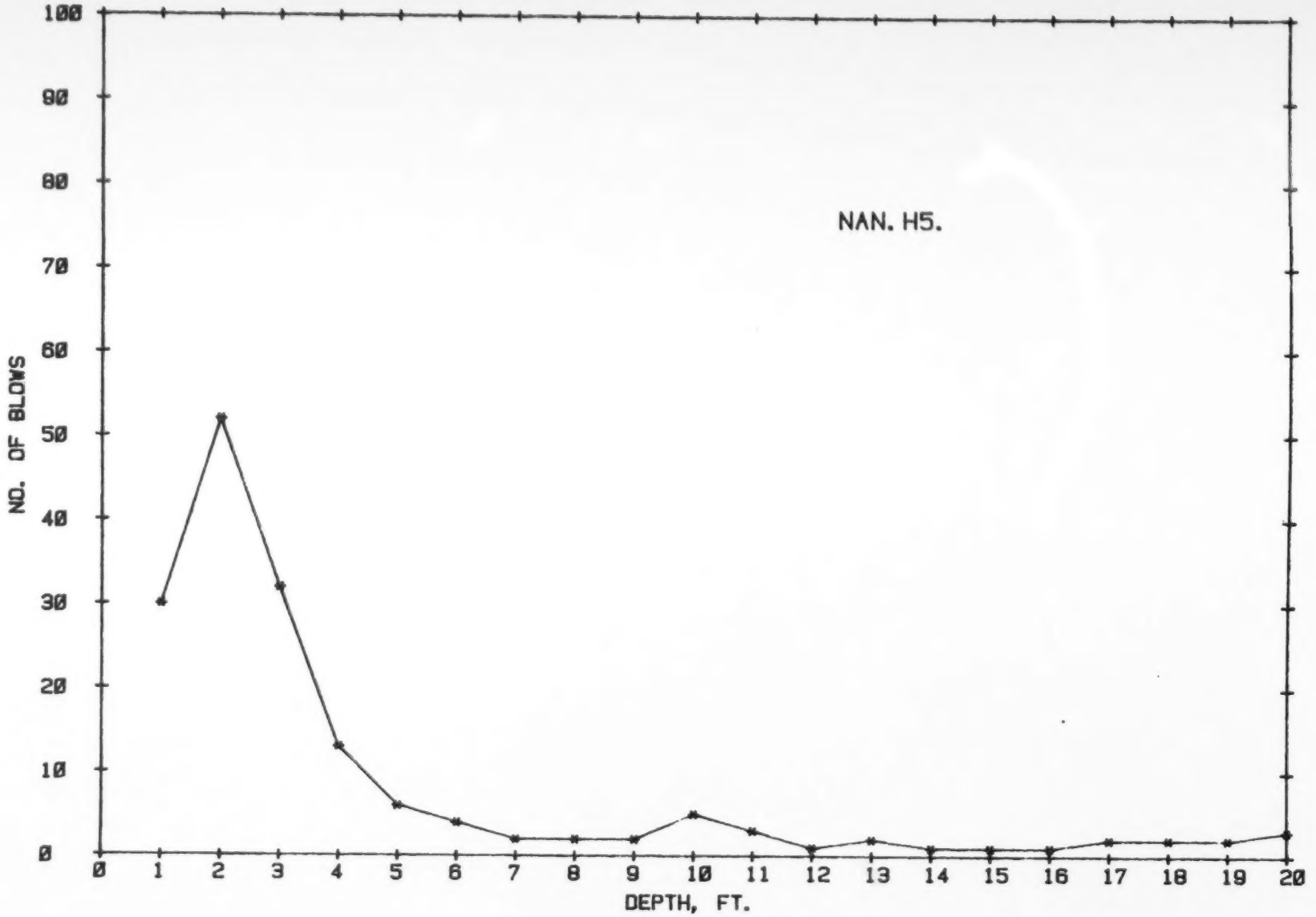
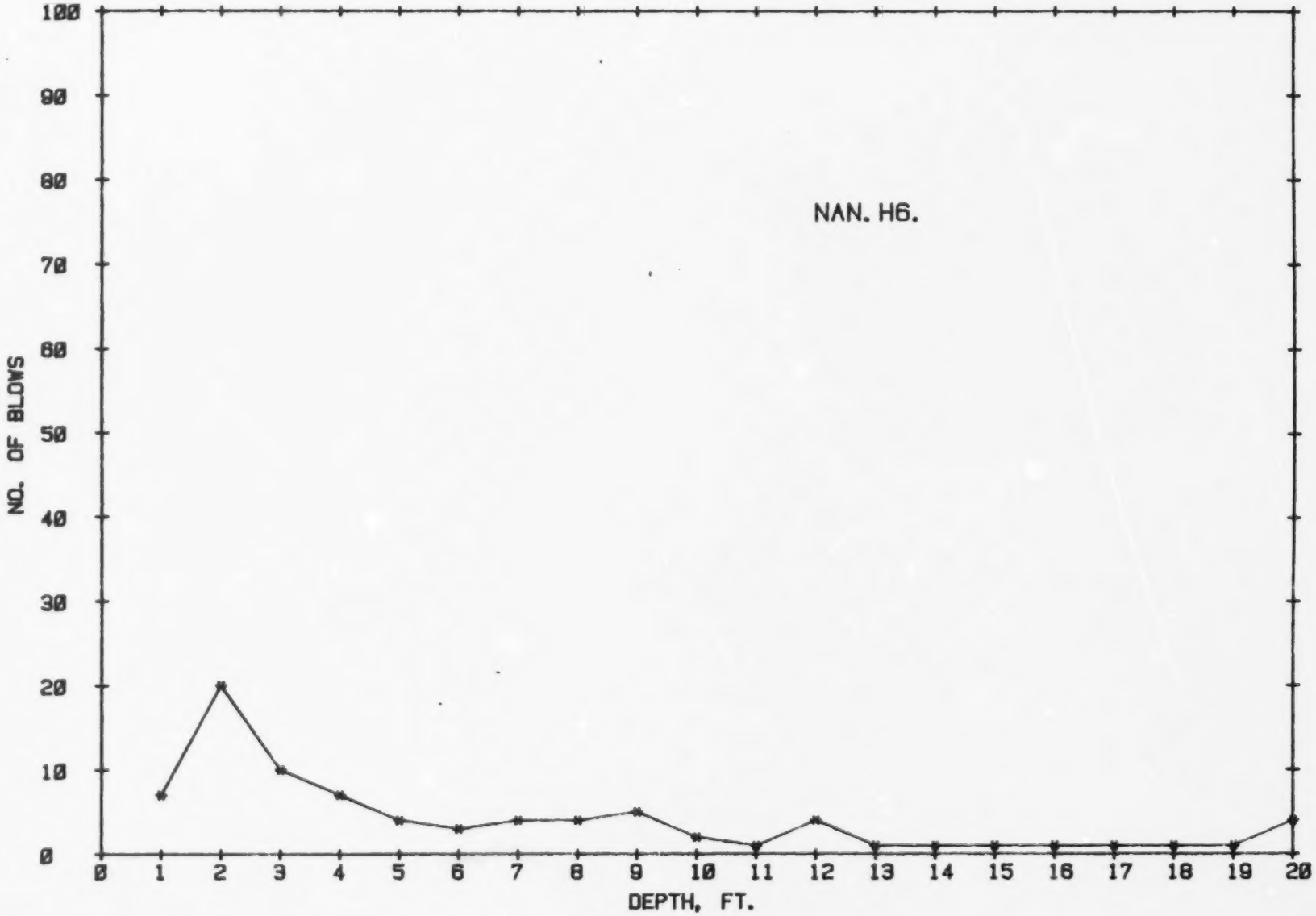
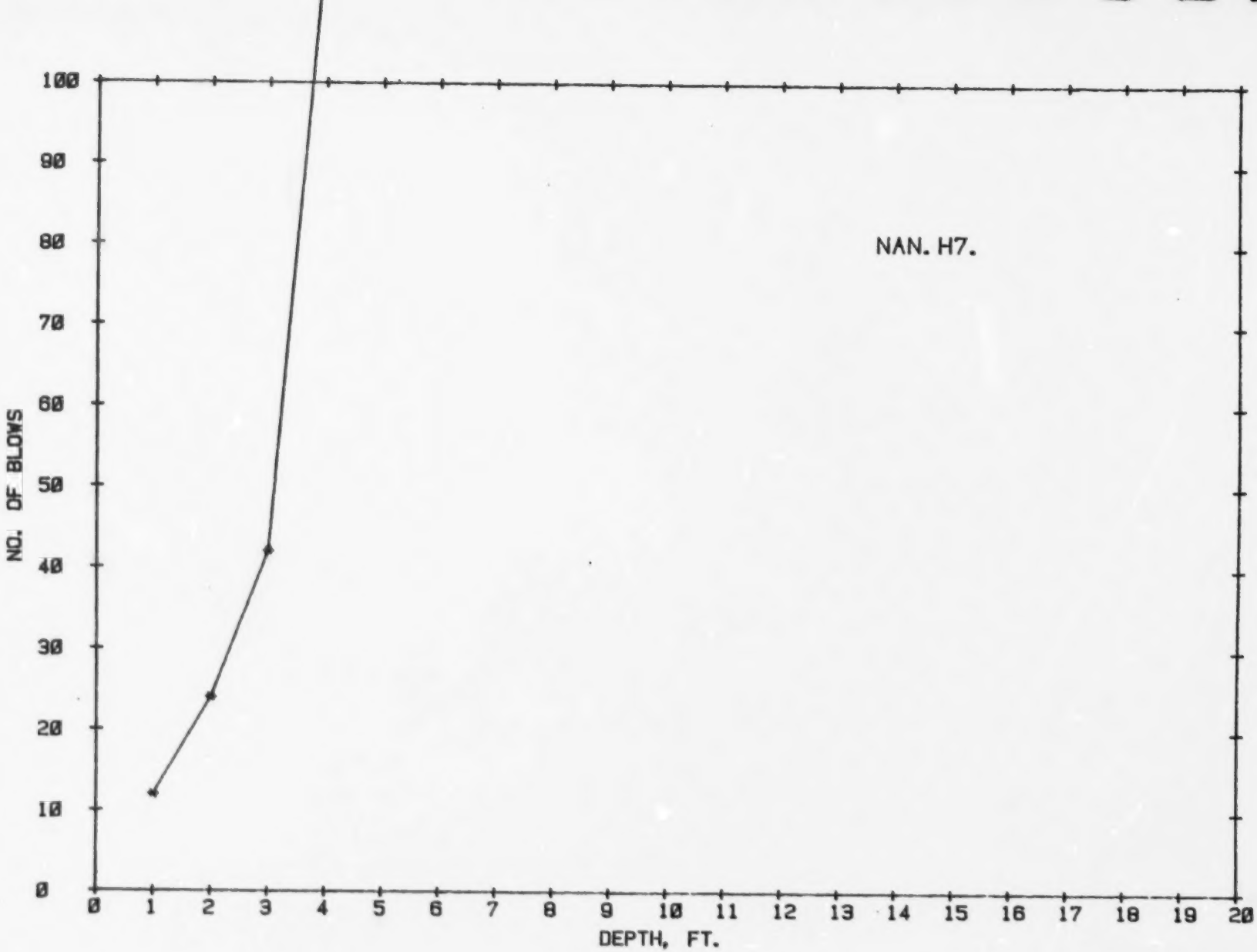
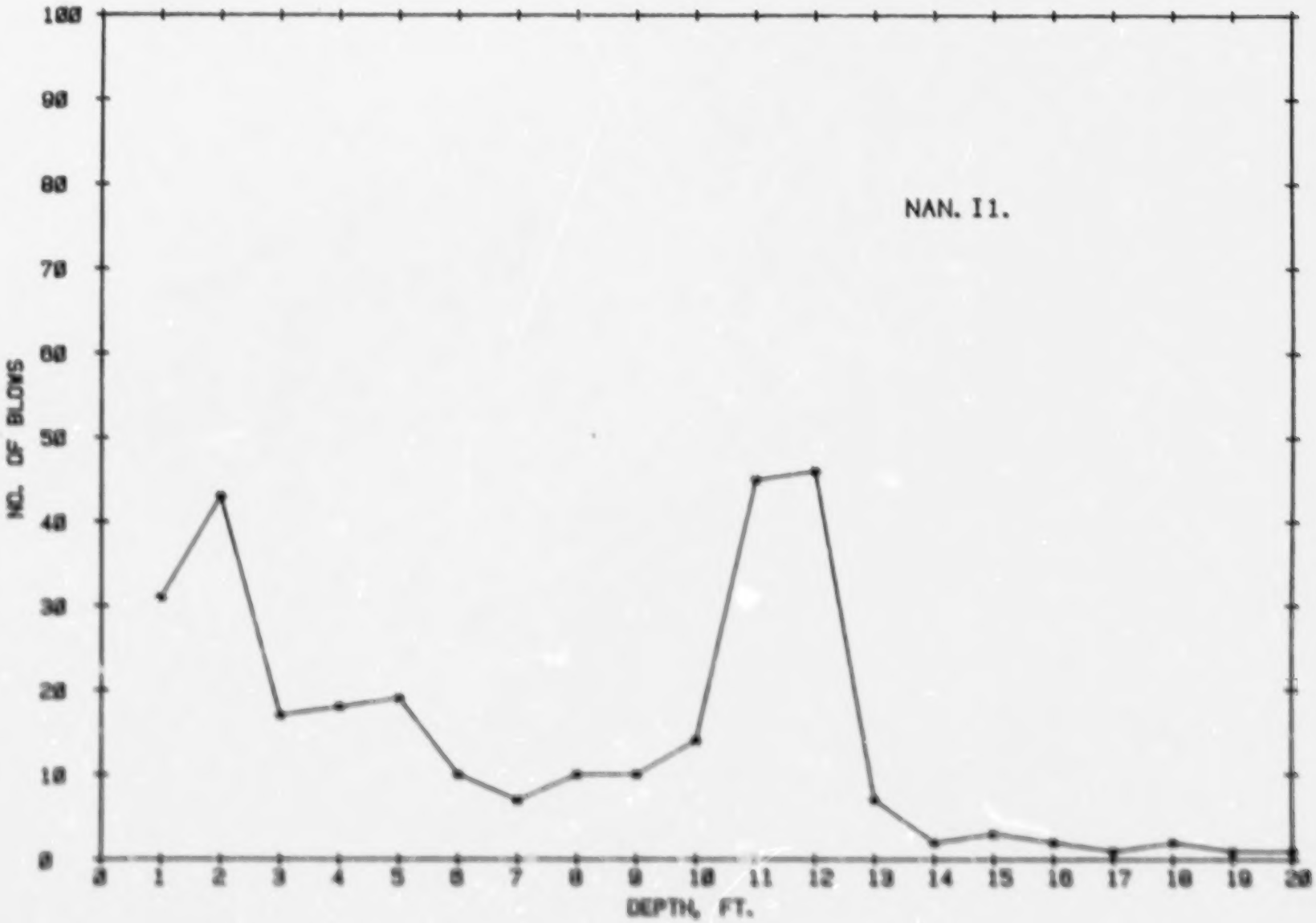
100
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. H5.
NO. OF BLOWS
100
90
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. H6.
NO. OF BLOWS
100
90
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. H7.
NO. OF BLOWS
0
10
20
30
40
50
60
70
80
90
100
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. I1.
NO. OF BLOWS
100
90
80
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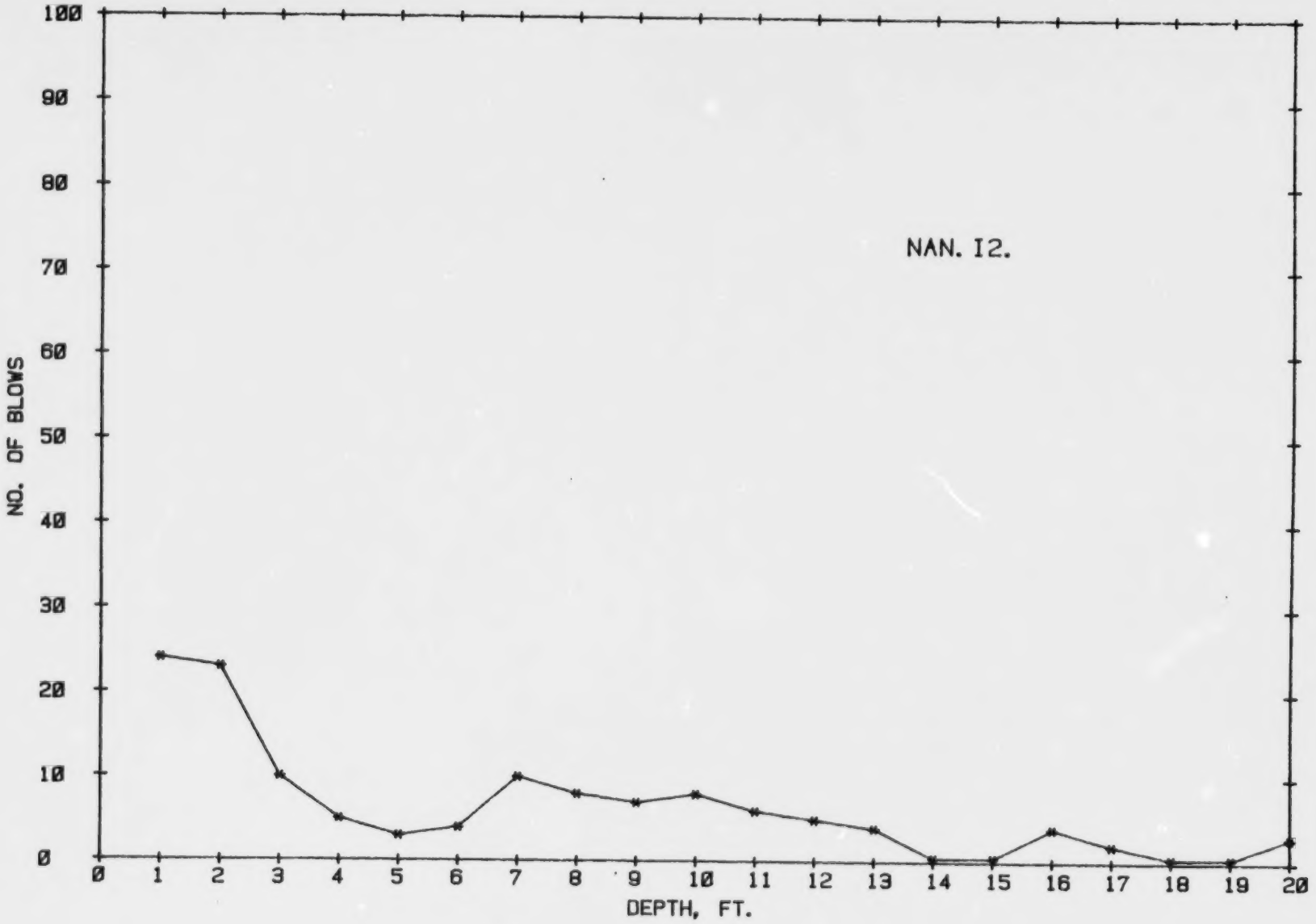
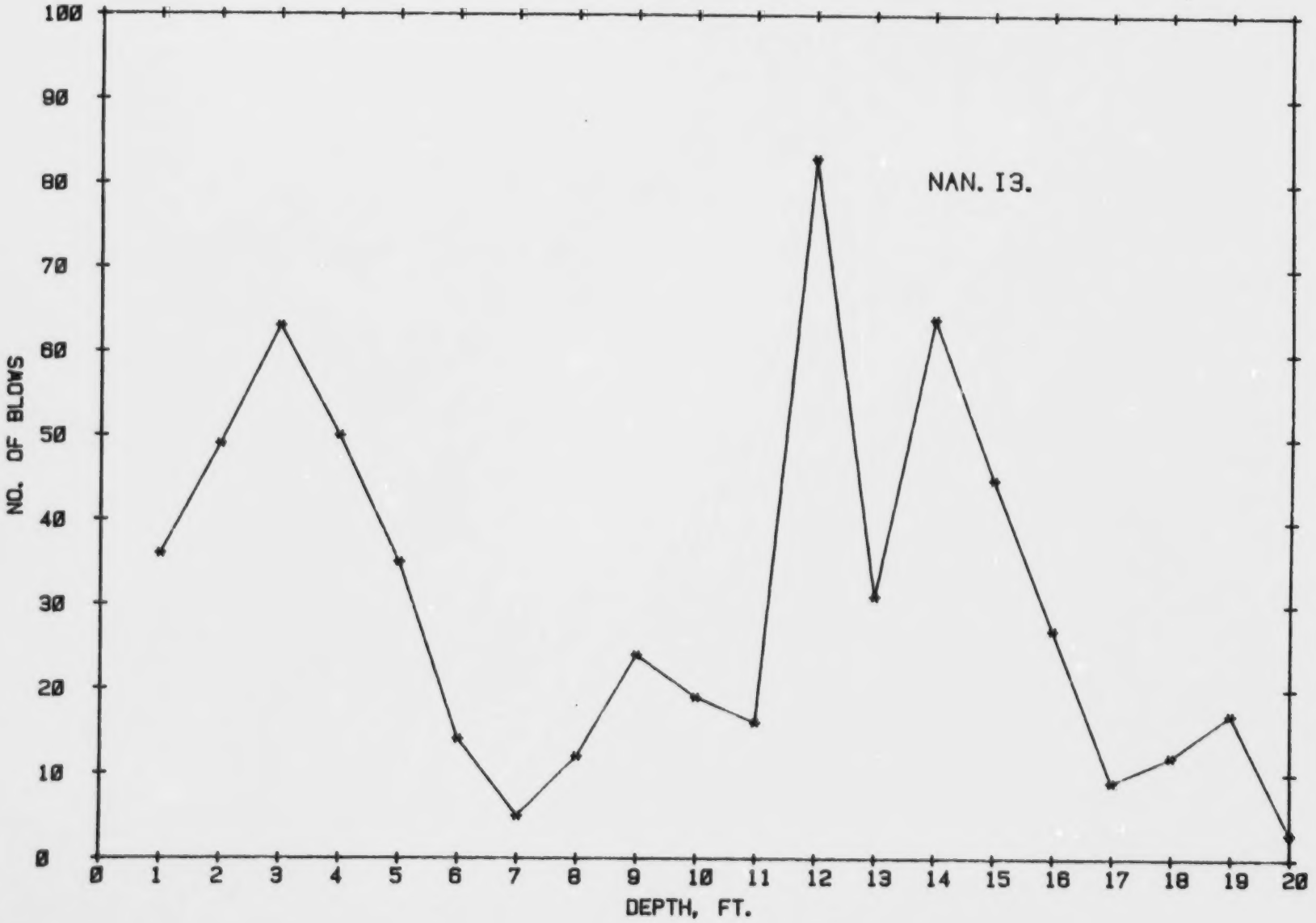
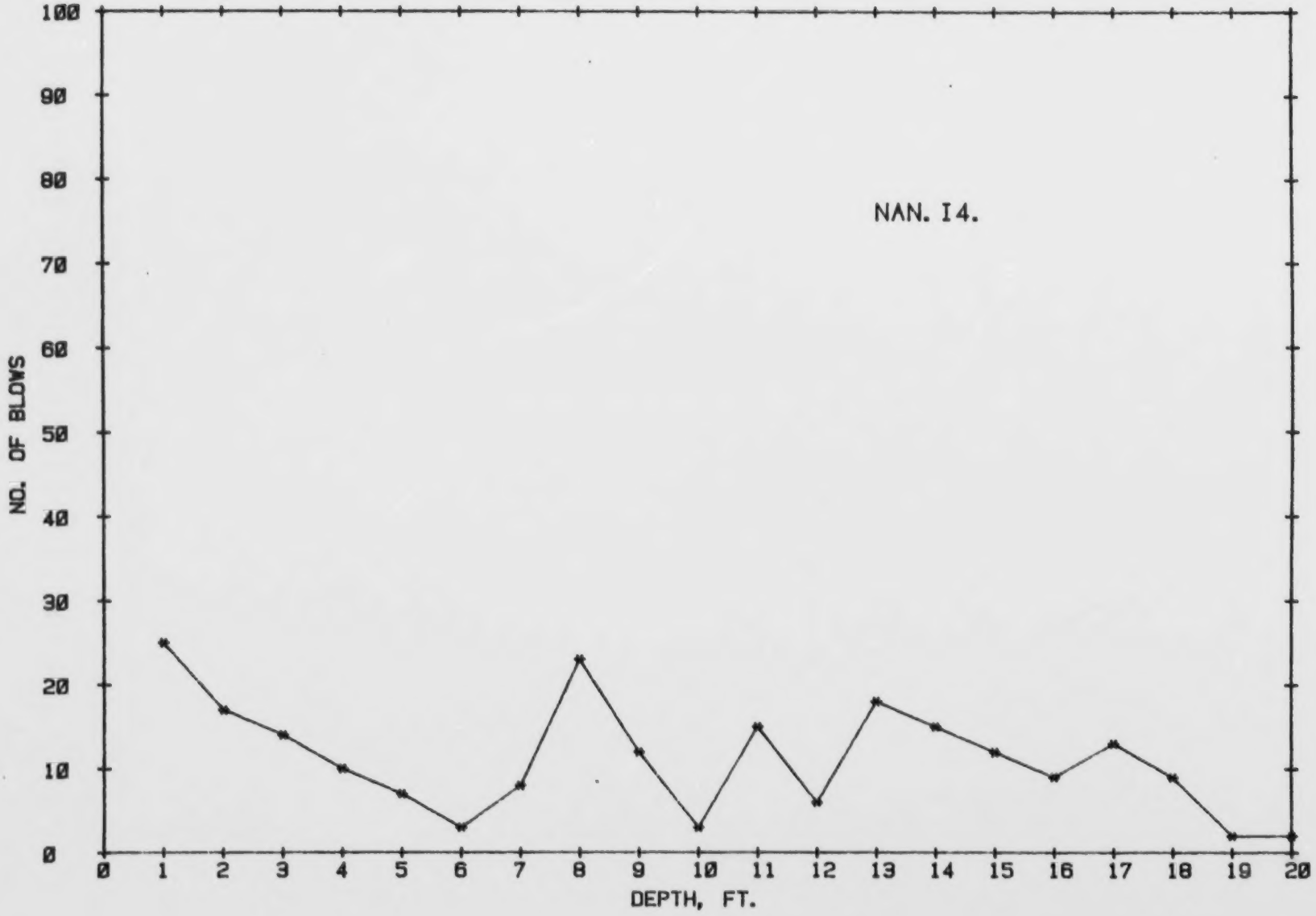
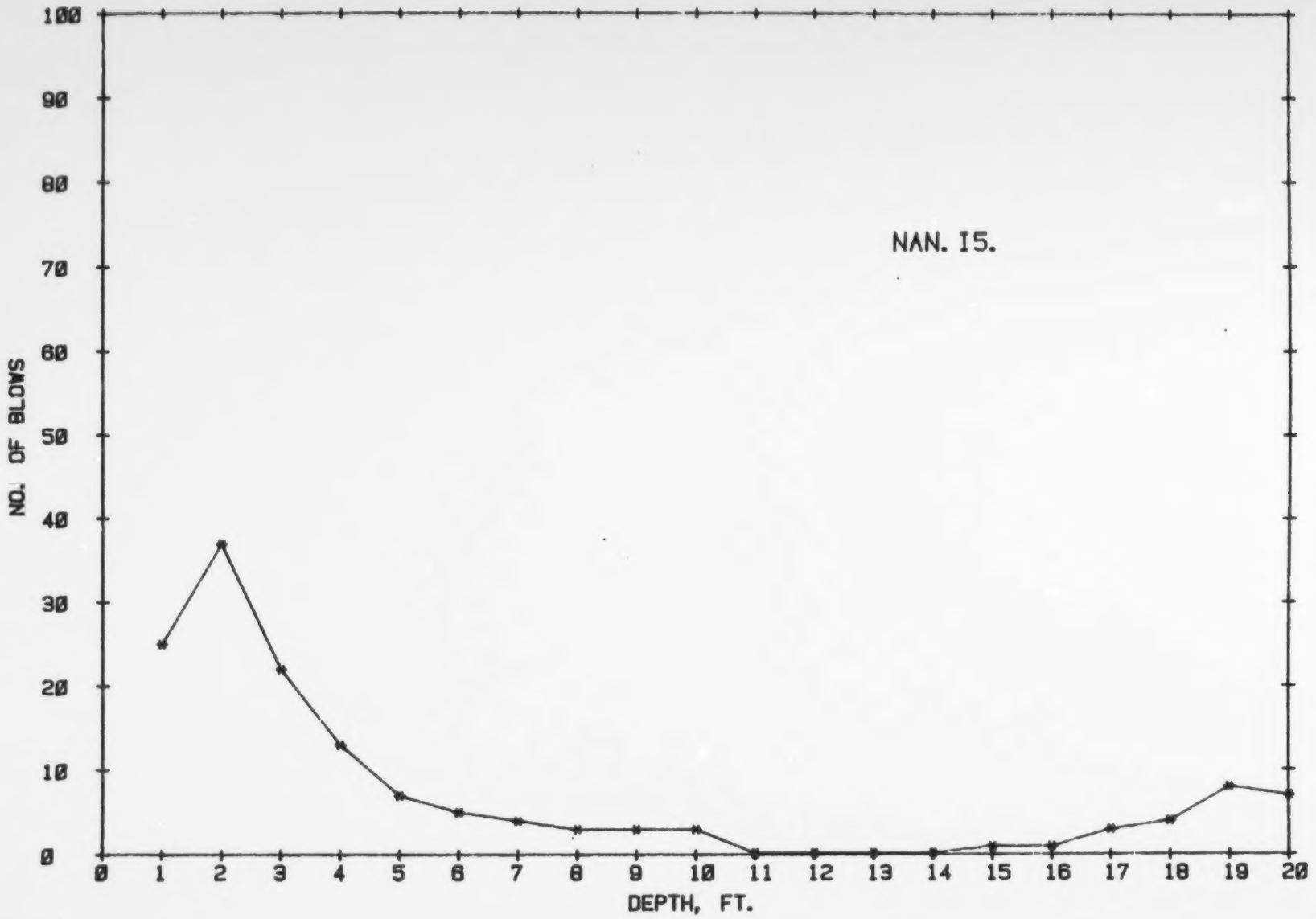
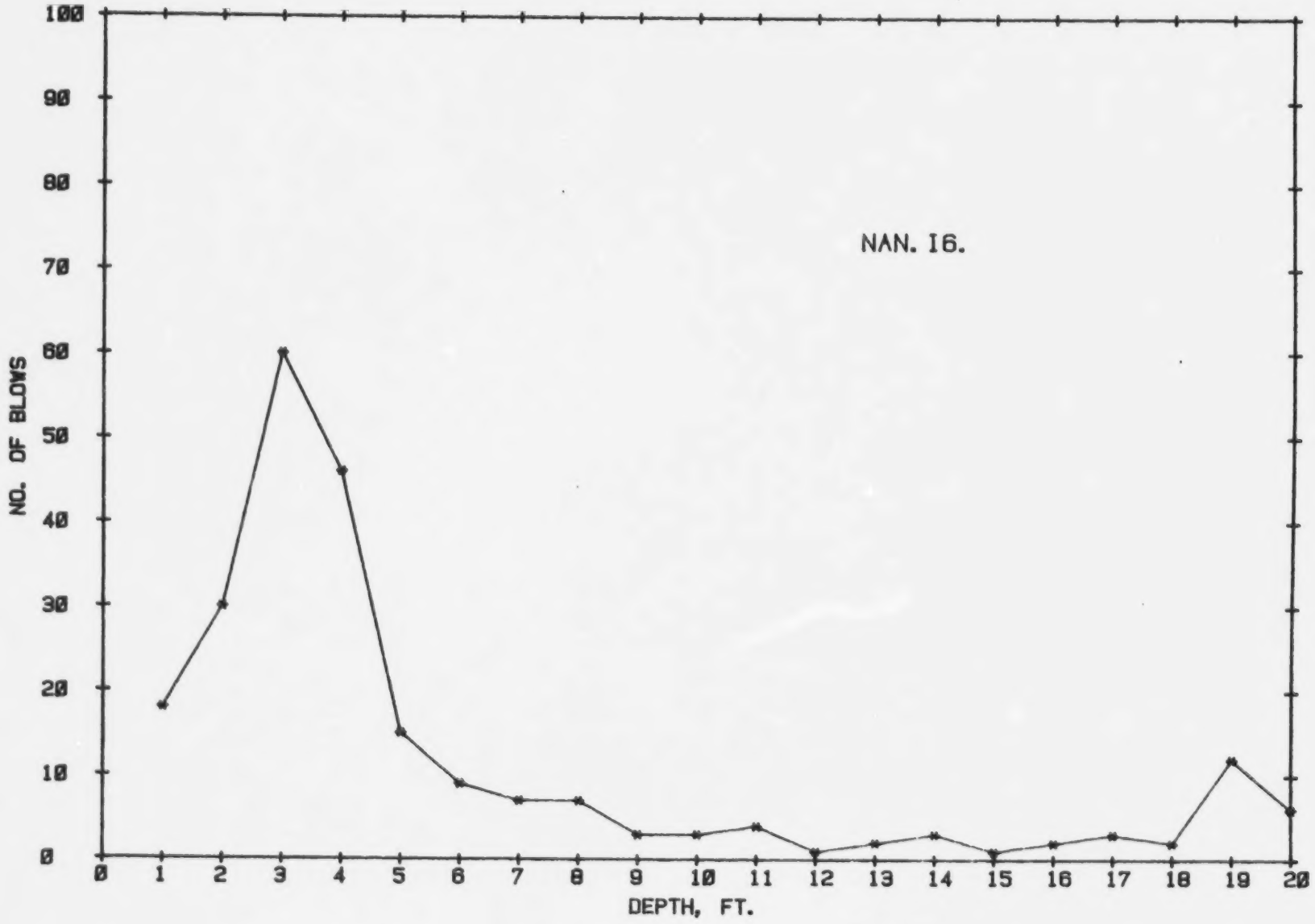
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.

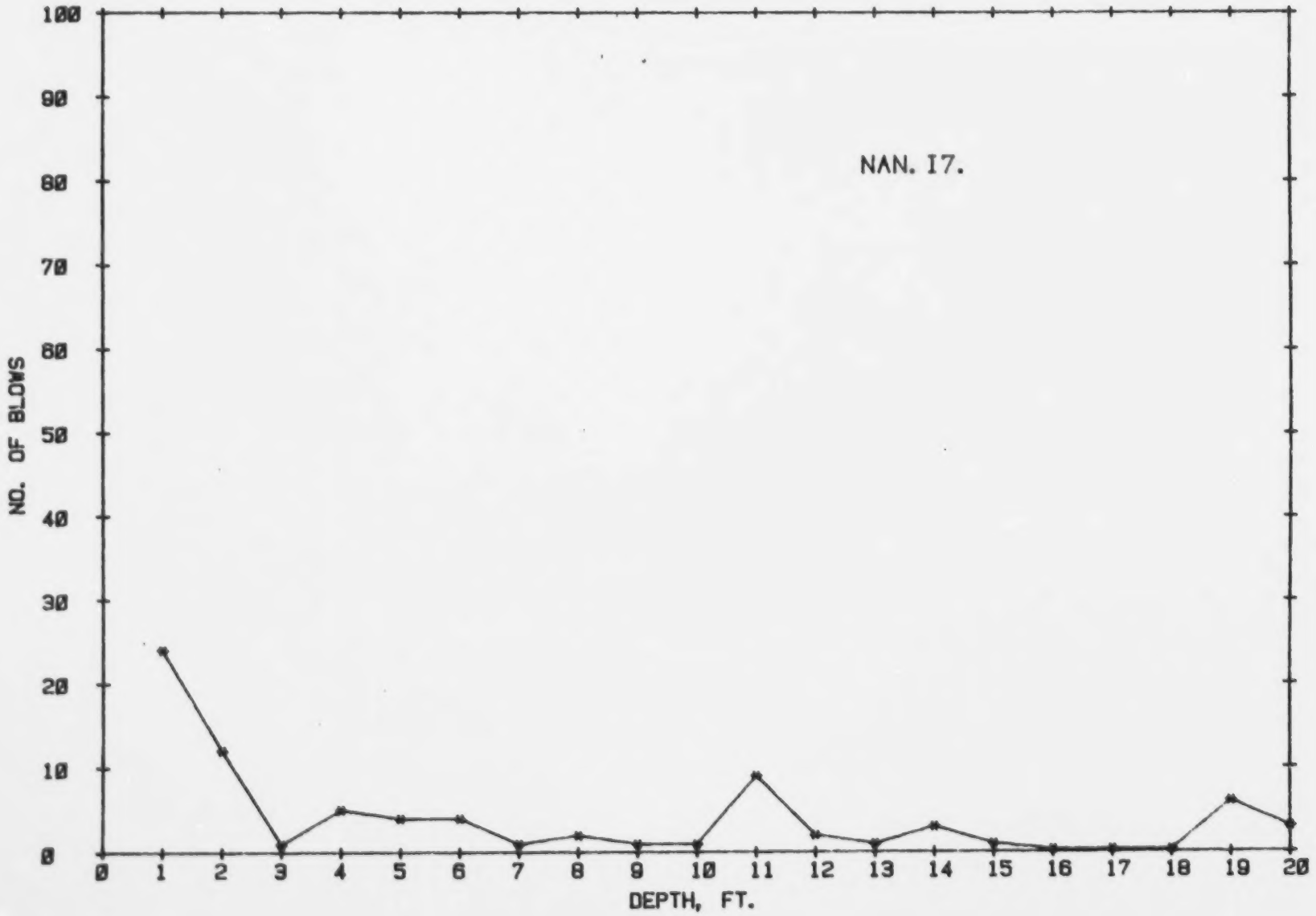

NAN. I2.
NO. OF BLOWS
100
90
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.

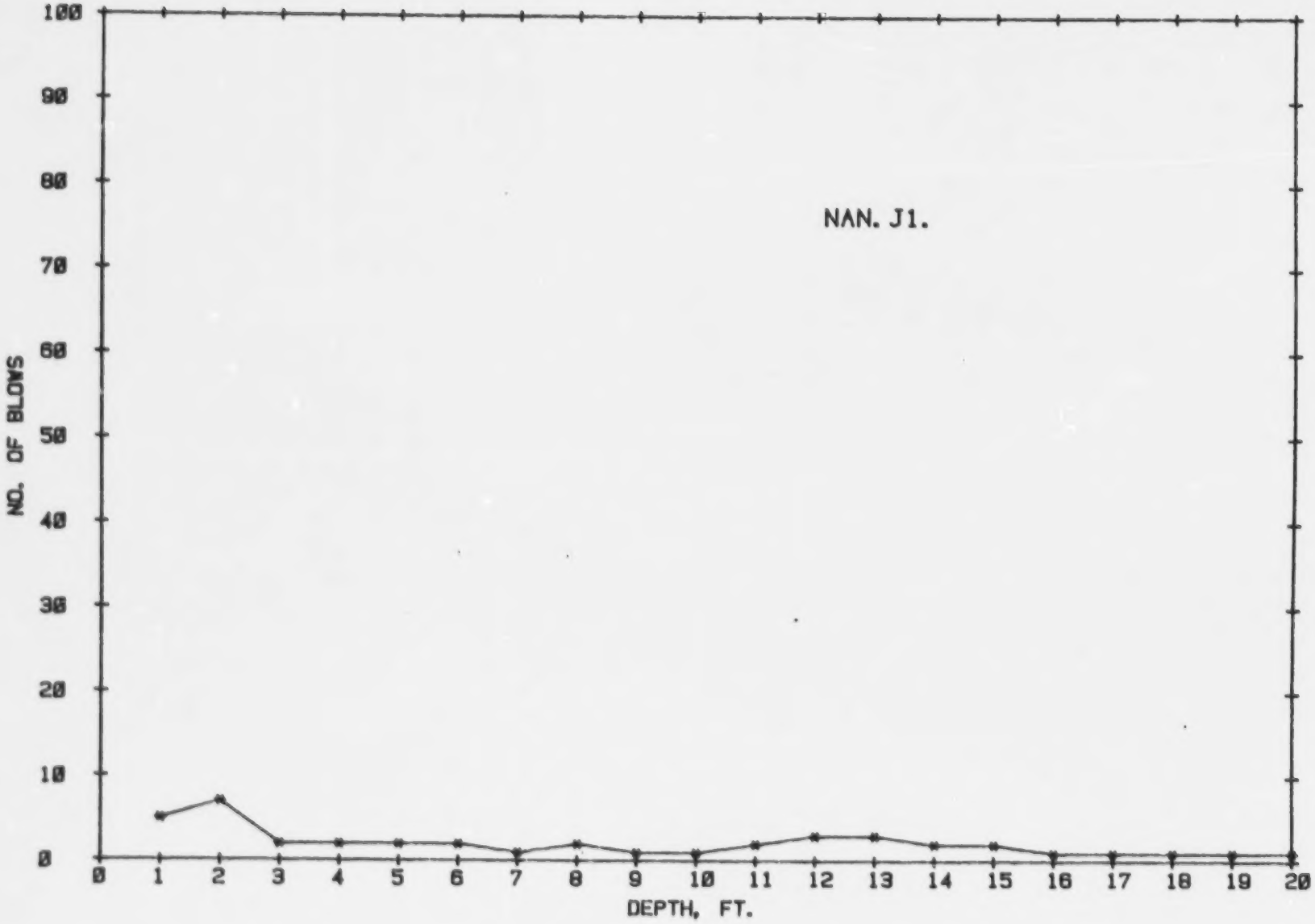

NAN. 13.
NO. OF BLOWS
DEPTH, FT.
100
90
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

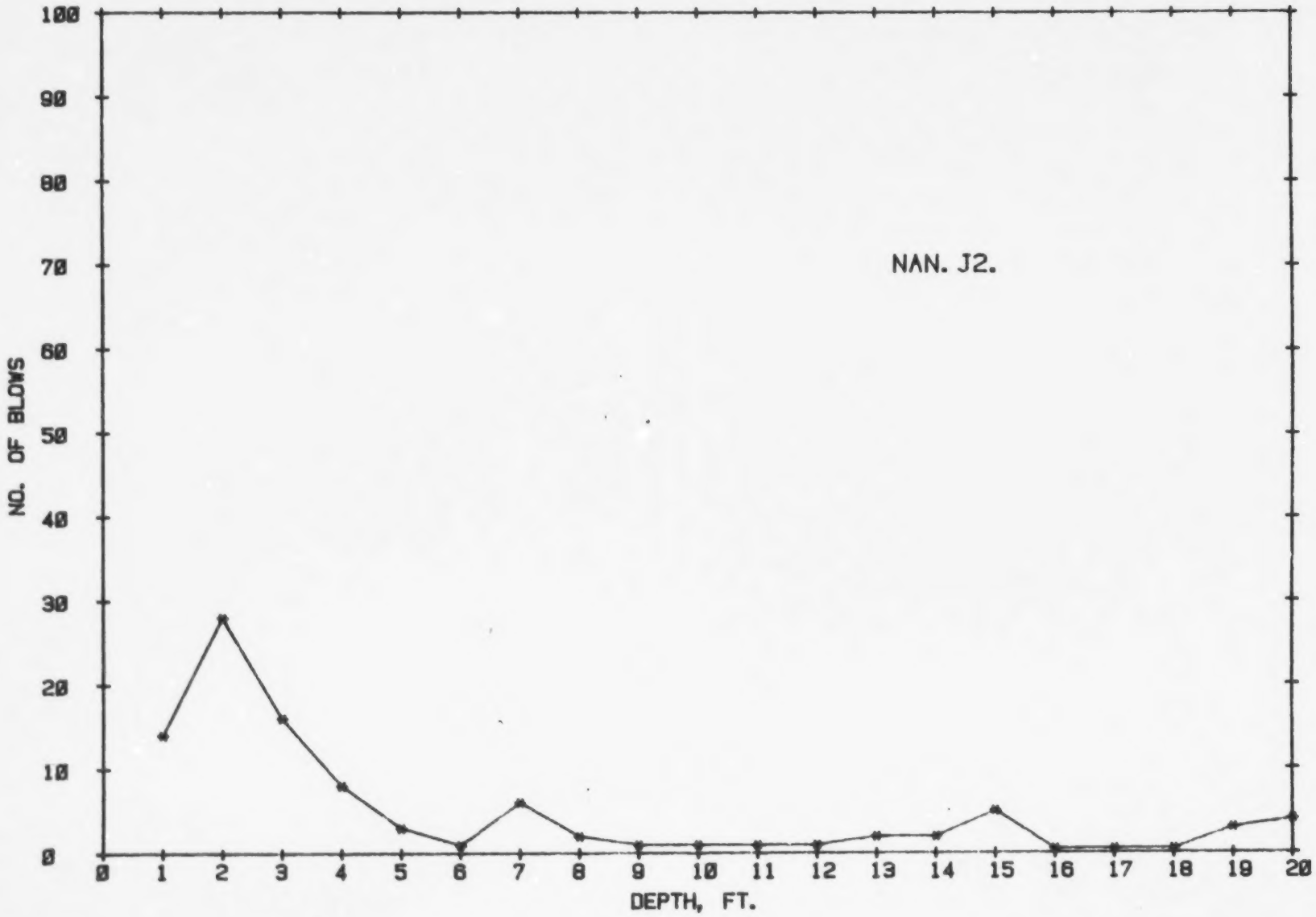

NAN. I4.
NO. OF BLOWS
100
90
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.

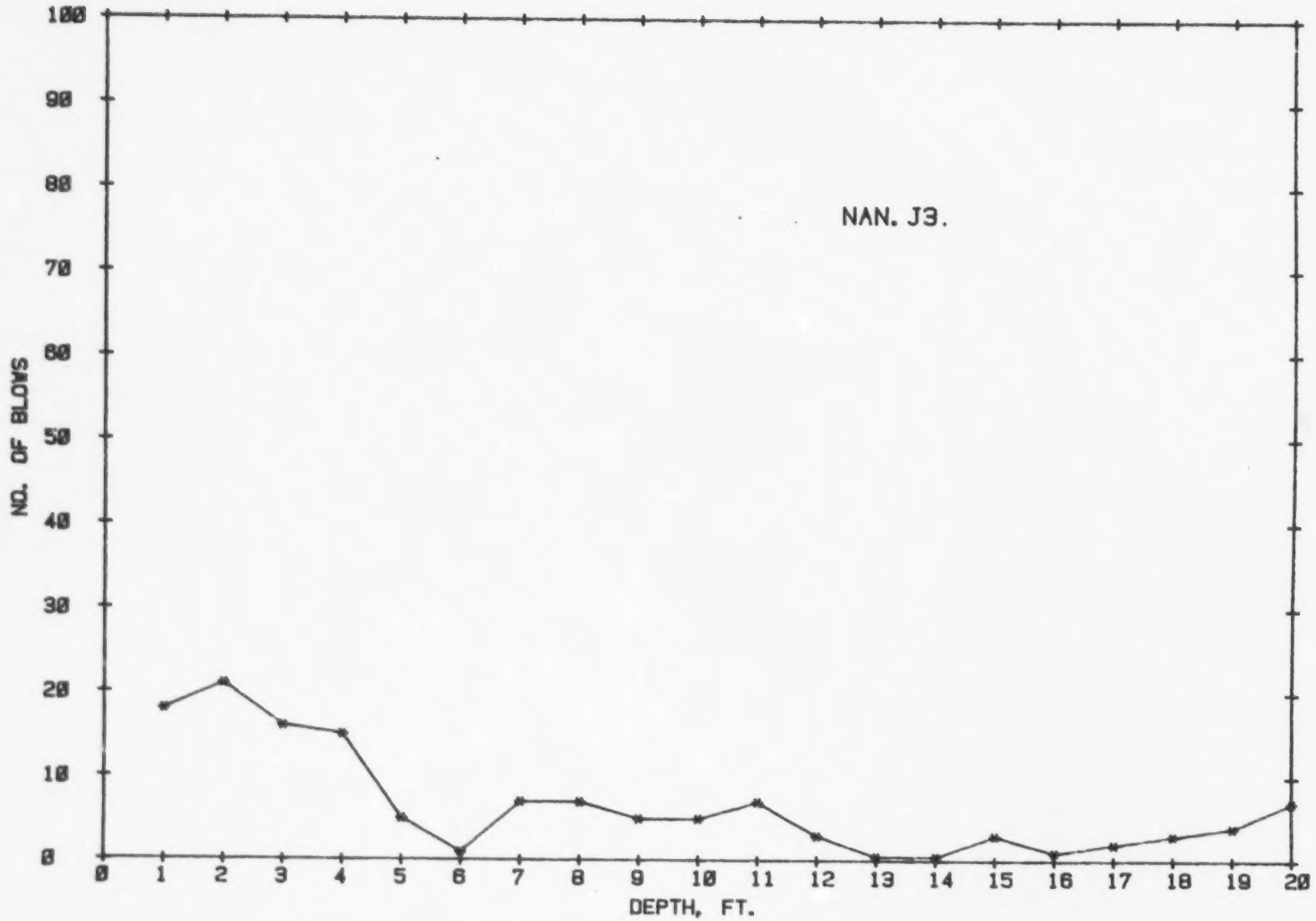

NAN. I5.
NO. OF BLOWS
0
10
20
30
40
50
60
70
80
90
100
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.

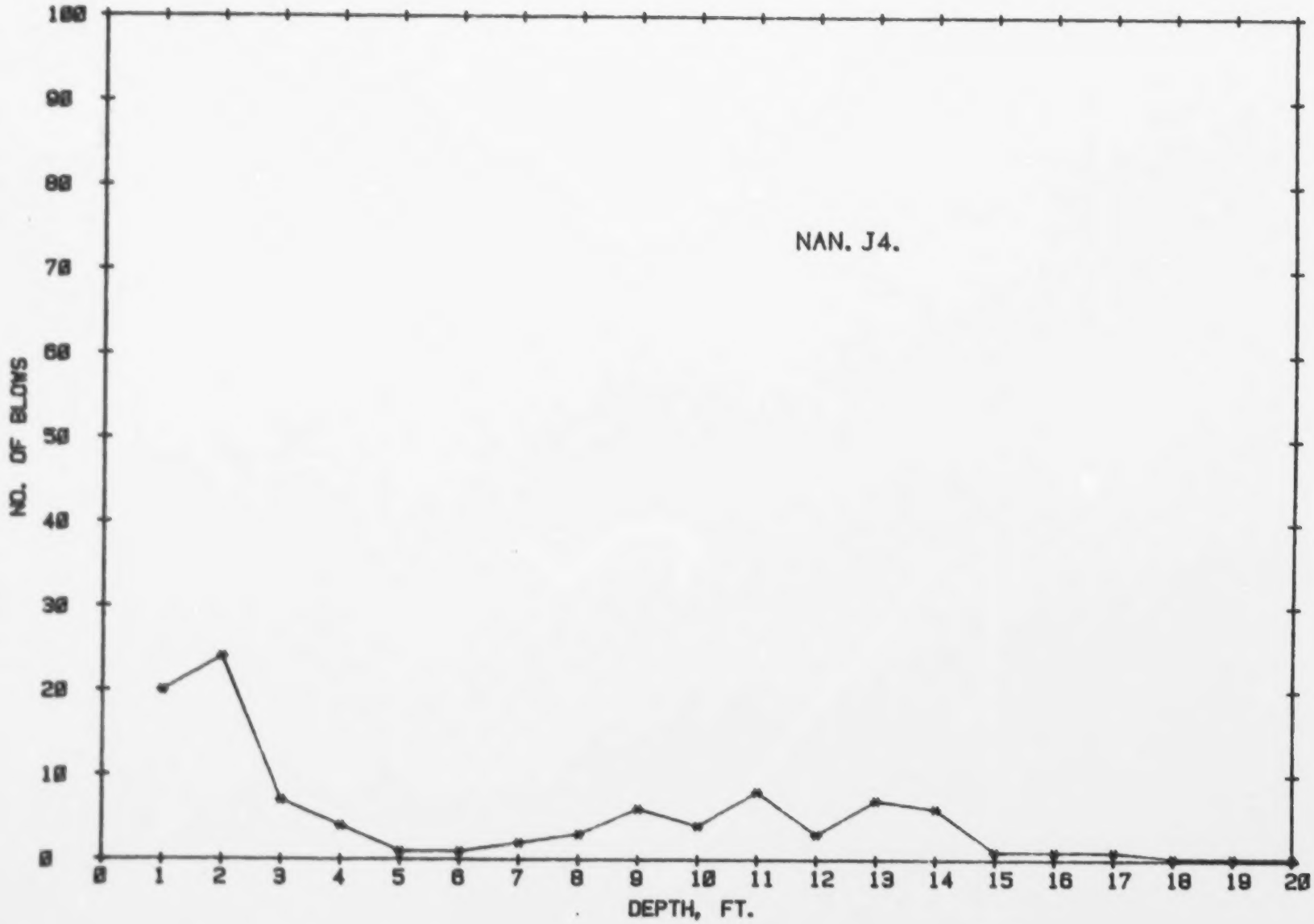

NAN. 16.
NO. OF BLOWS
DEPTH, FT.
100
90
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

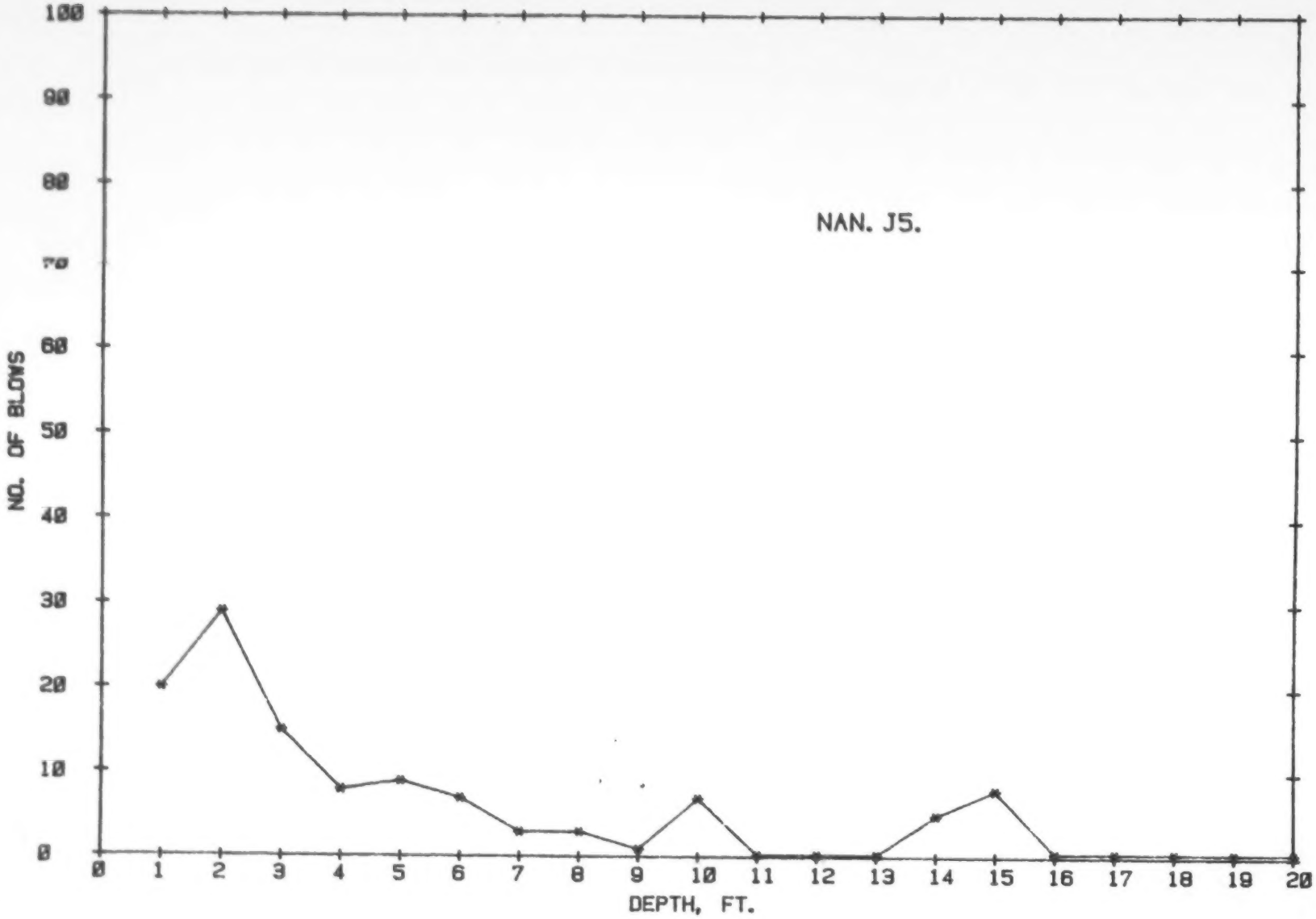

NAN. I7.
NO. OF BLOWS
100
90
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.

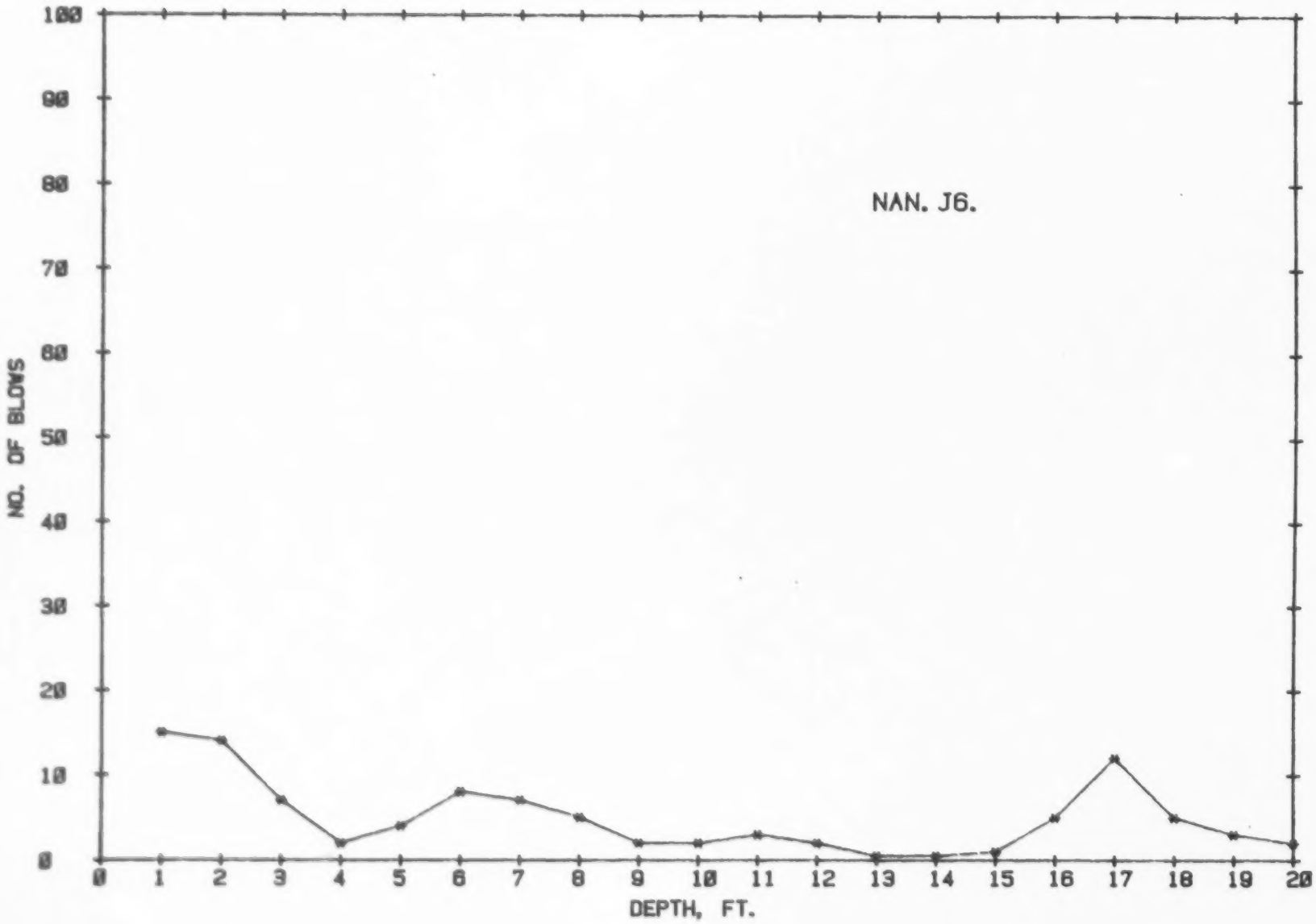

NAN. J1.
NO. OF BLOWS
100
90
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.

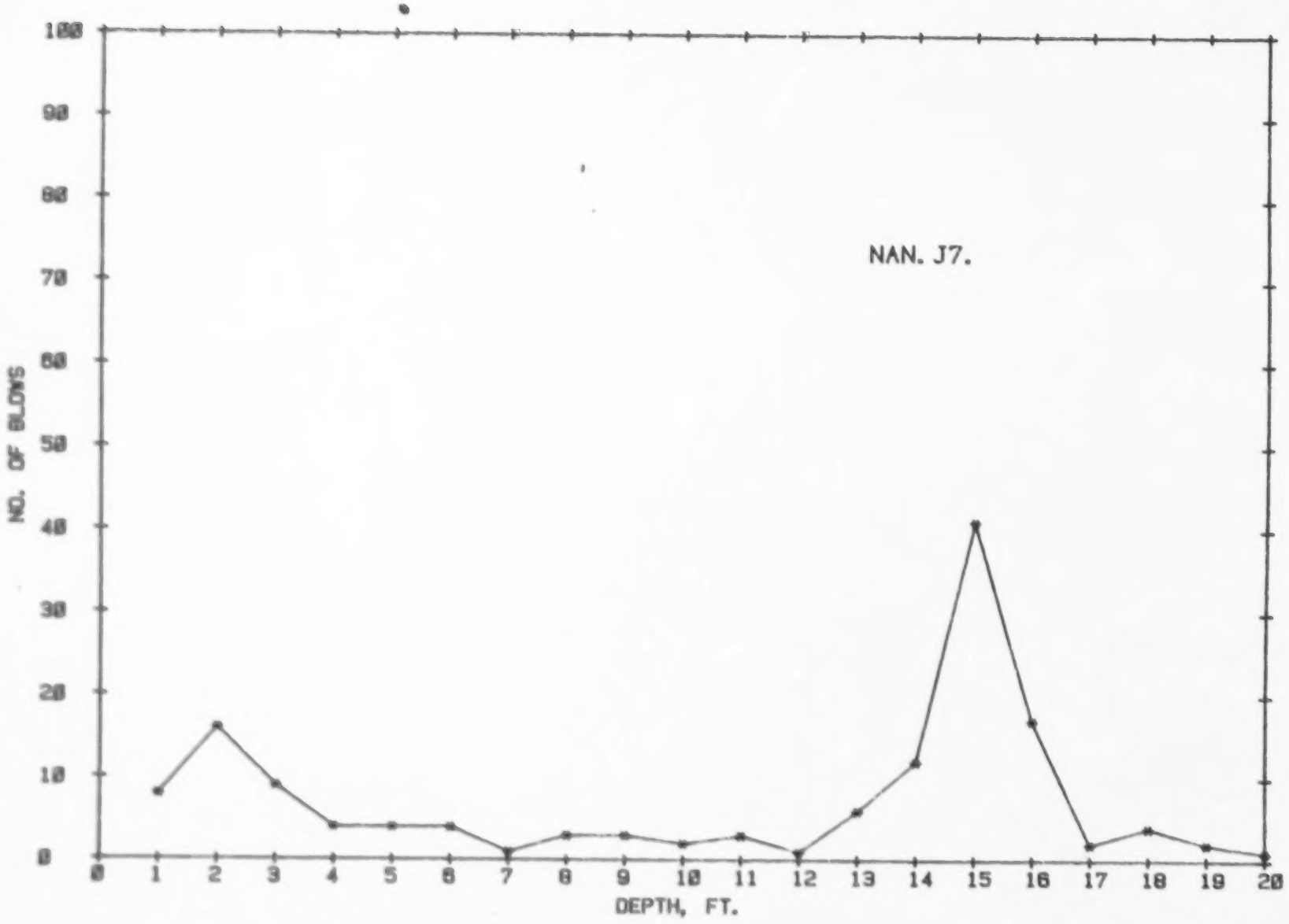

NAN. J2.
NO. OF BLOWS
100
90
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.

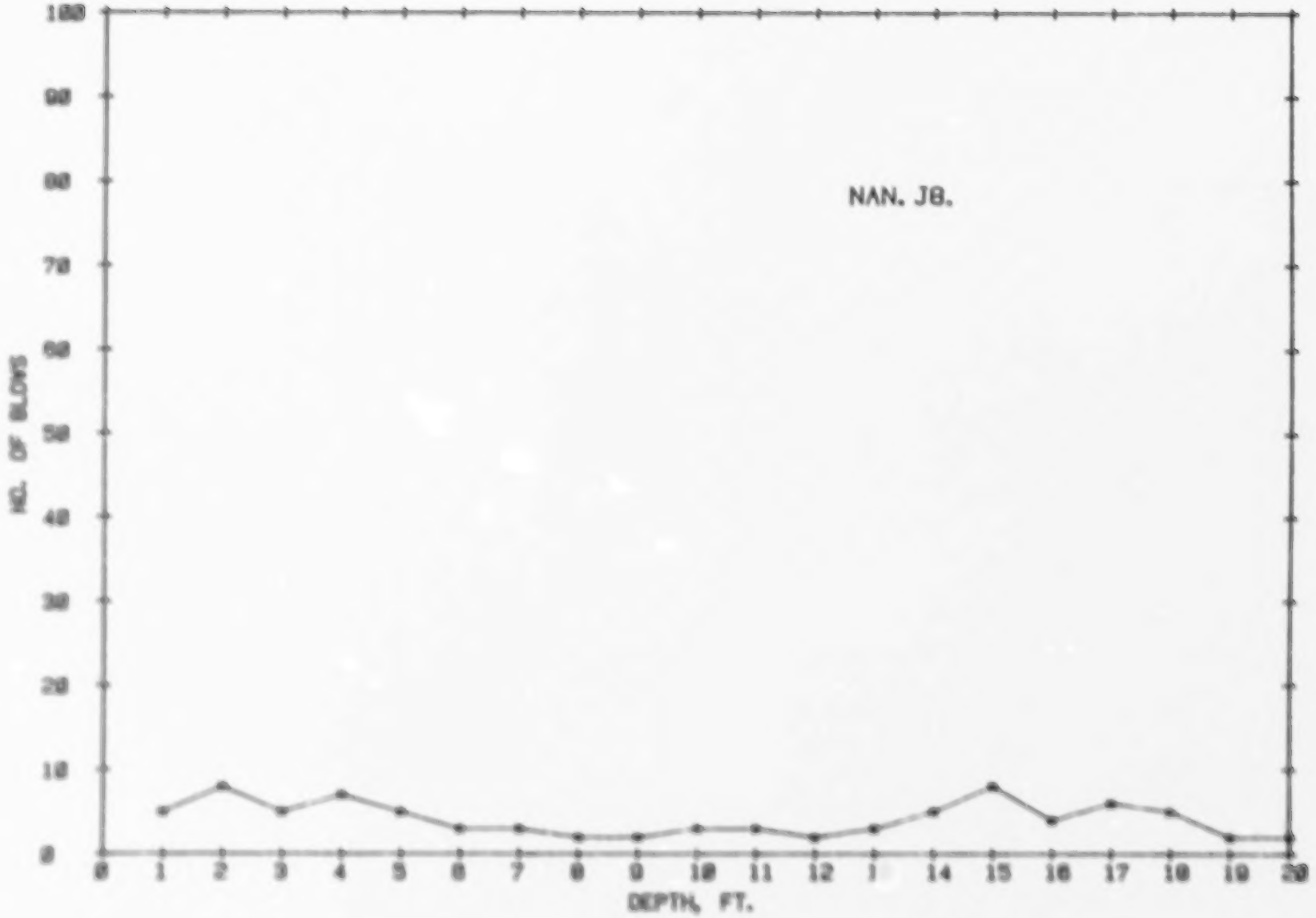

NAN. J3.
NO. OF BLOWS
100
90
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.

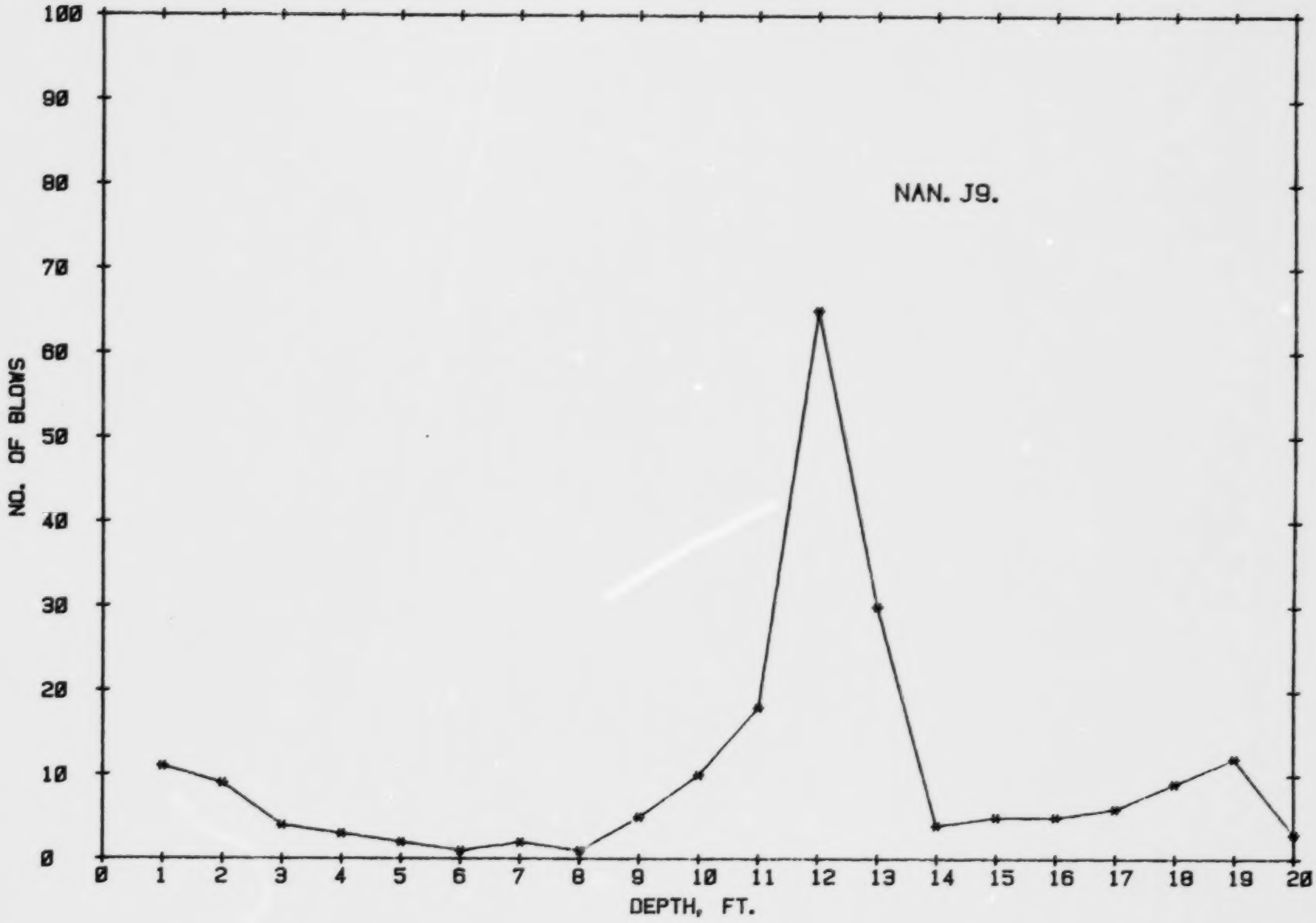

NAN. J4.
NO. OF BLOWS
100
90
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.

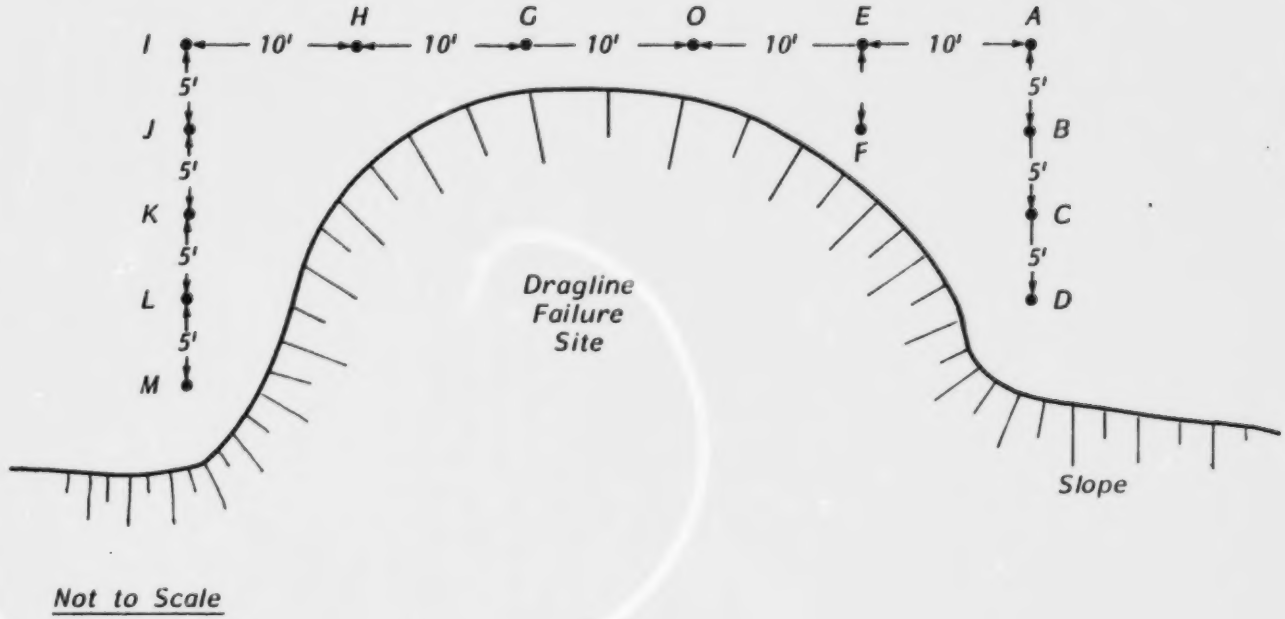

NAN. J5.
NO. OF BLOWS
100
90
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. J6.
NO. OF BLOWS
100
90
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. J7.
NO. OF BLOWS
100
90
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.

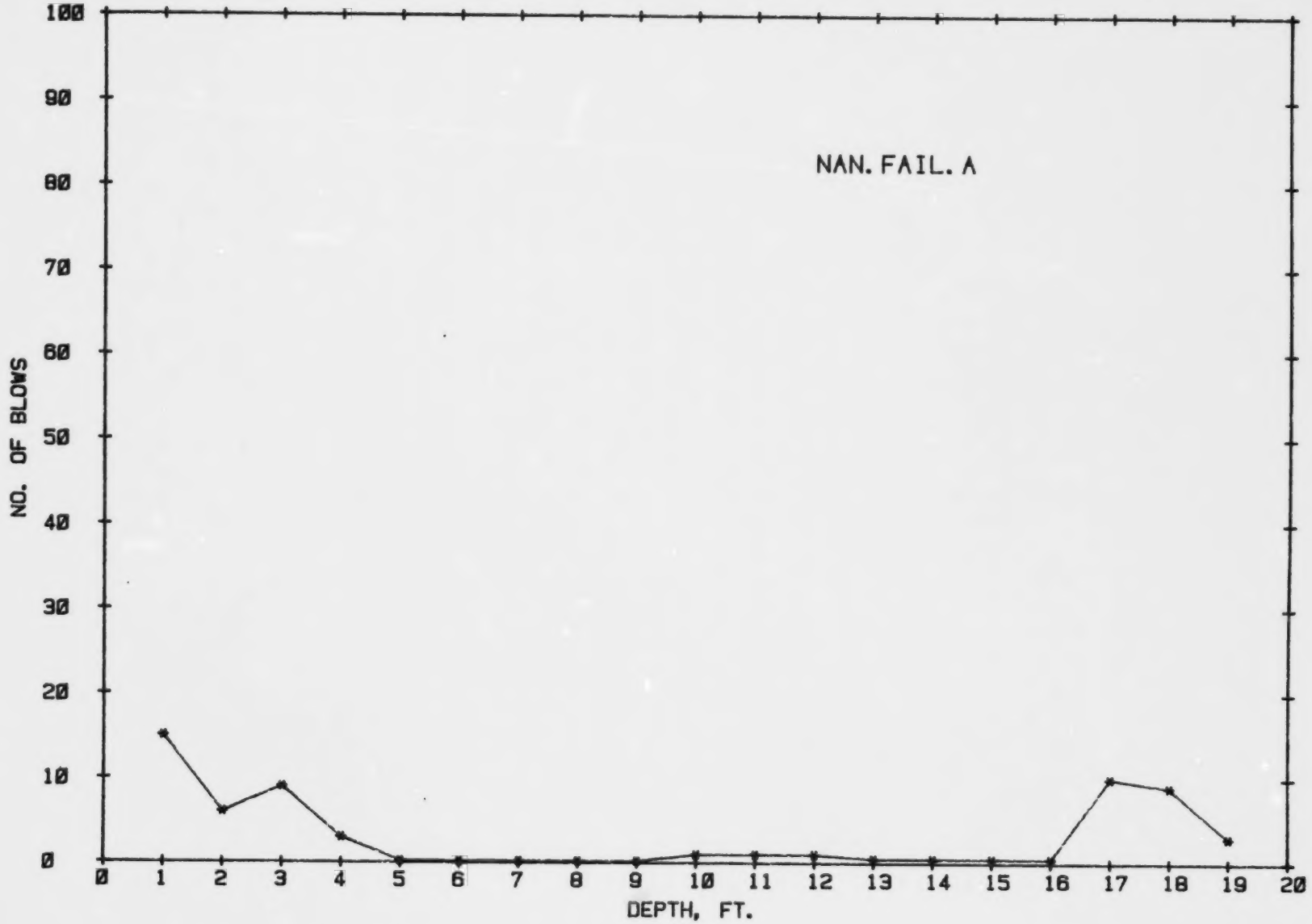

NAN. JB.
NO. OF BLOWS
100
90
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.

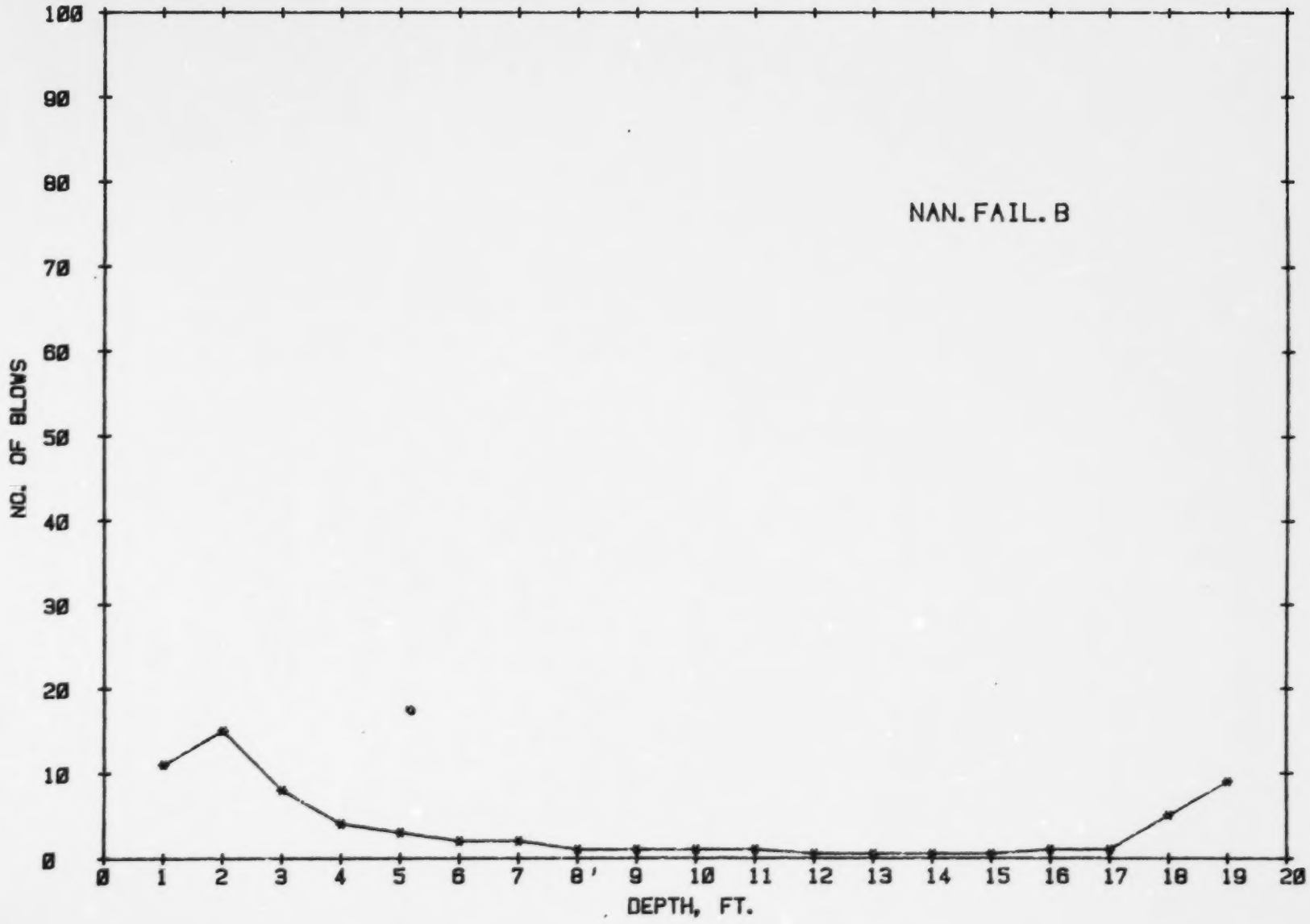

NAN. J9.
NO. OF BLOWS
DEPTH, FT.
100
90
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

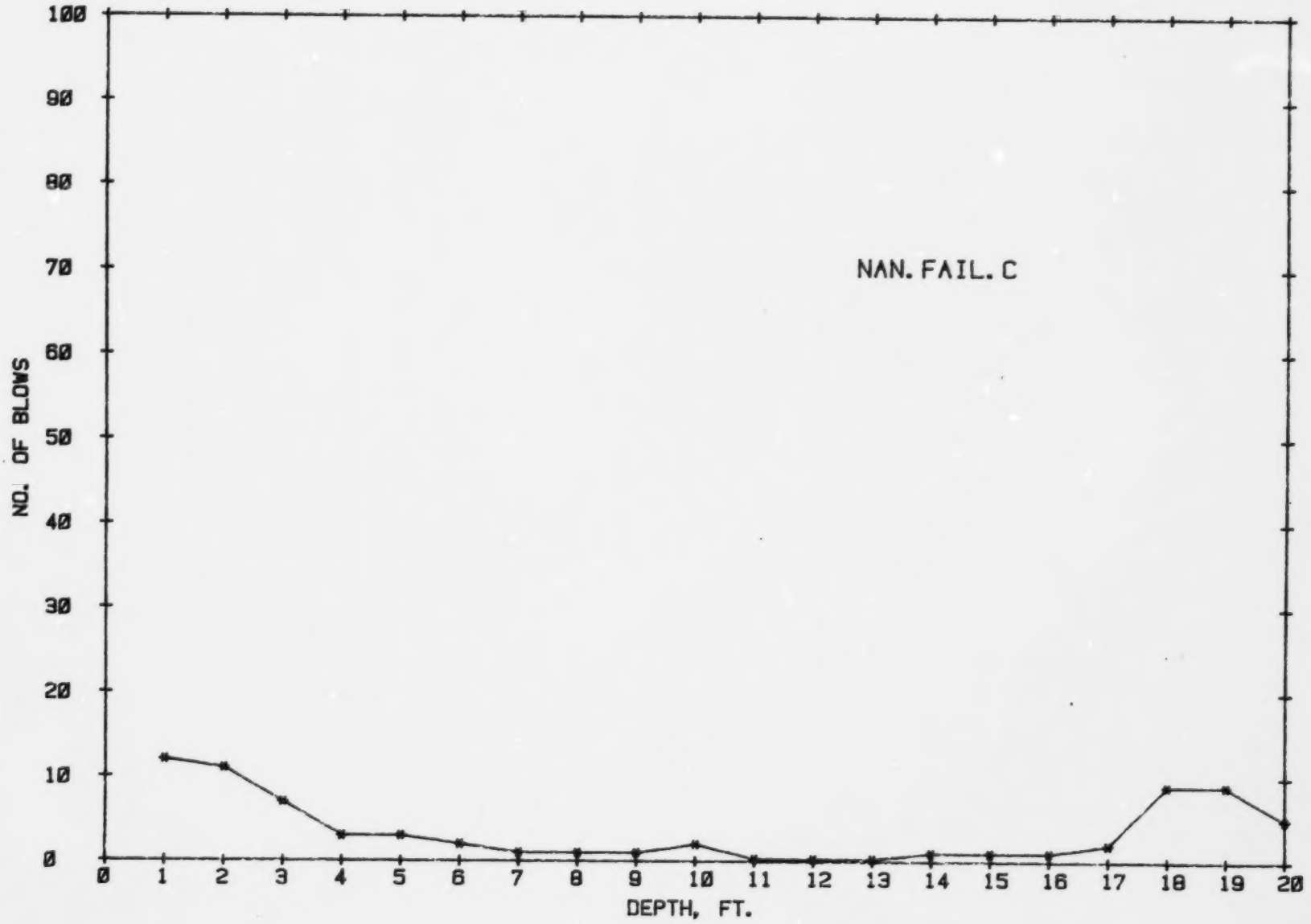


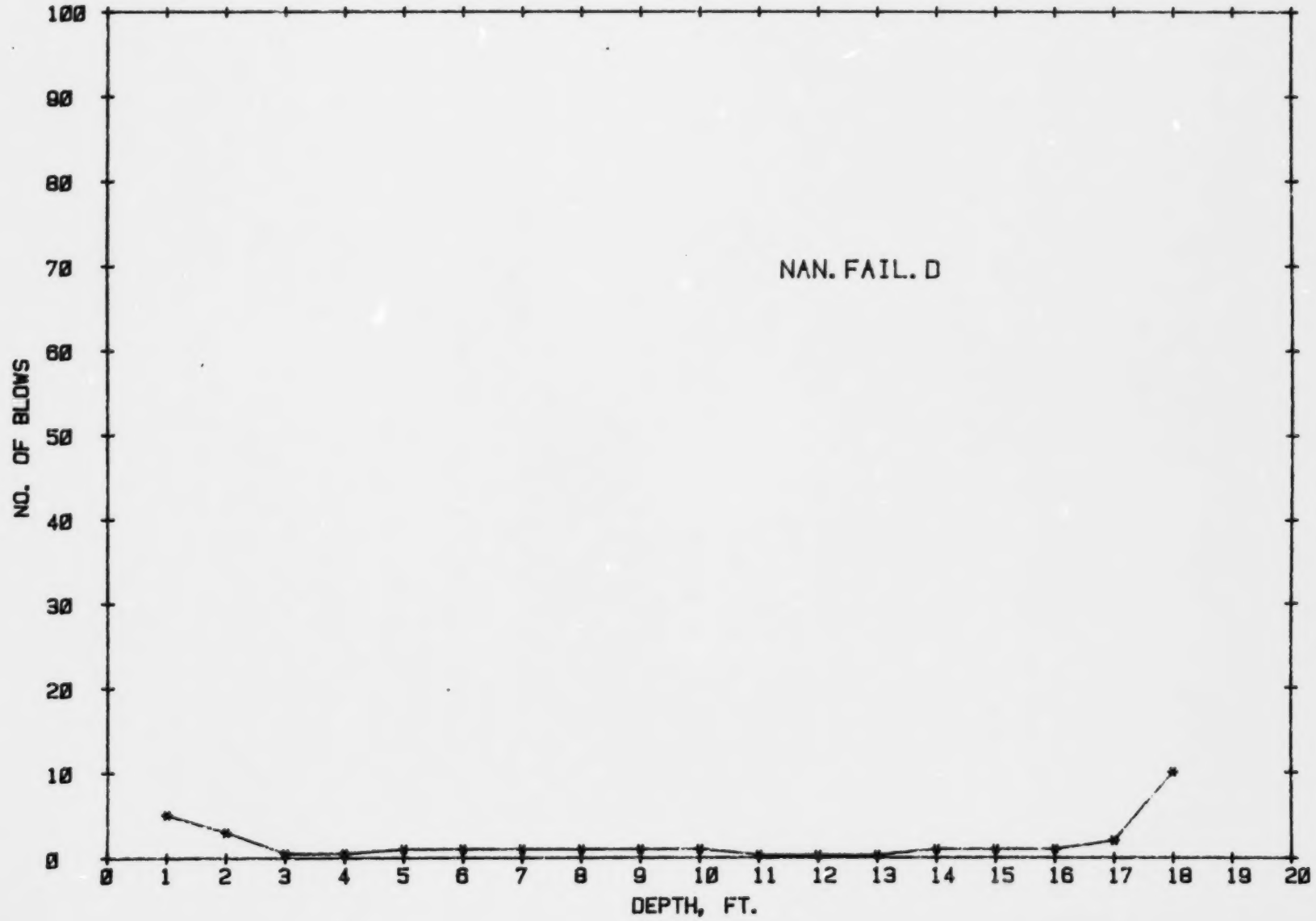
Not to Scale

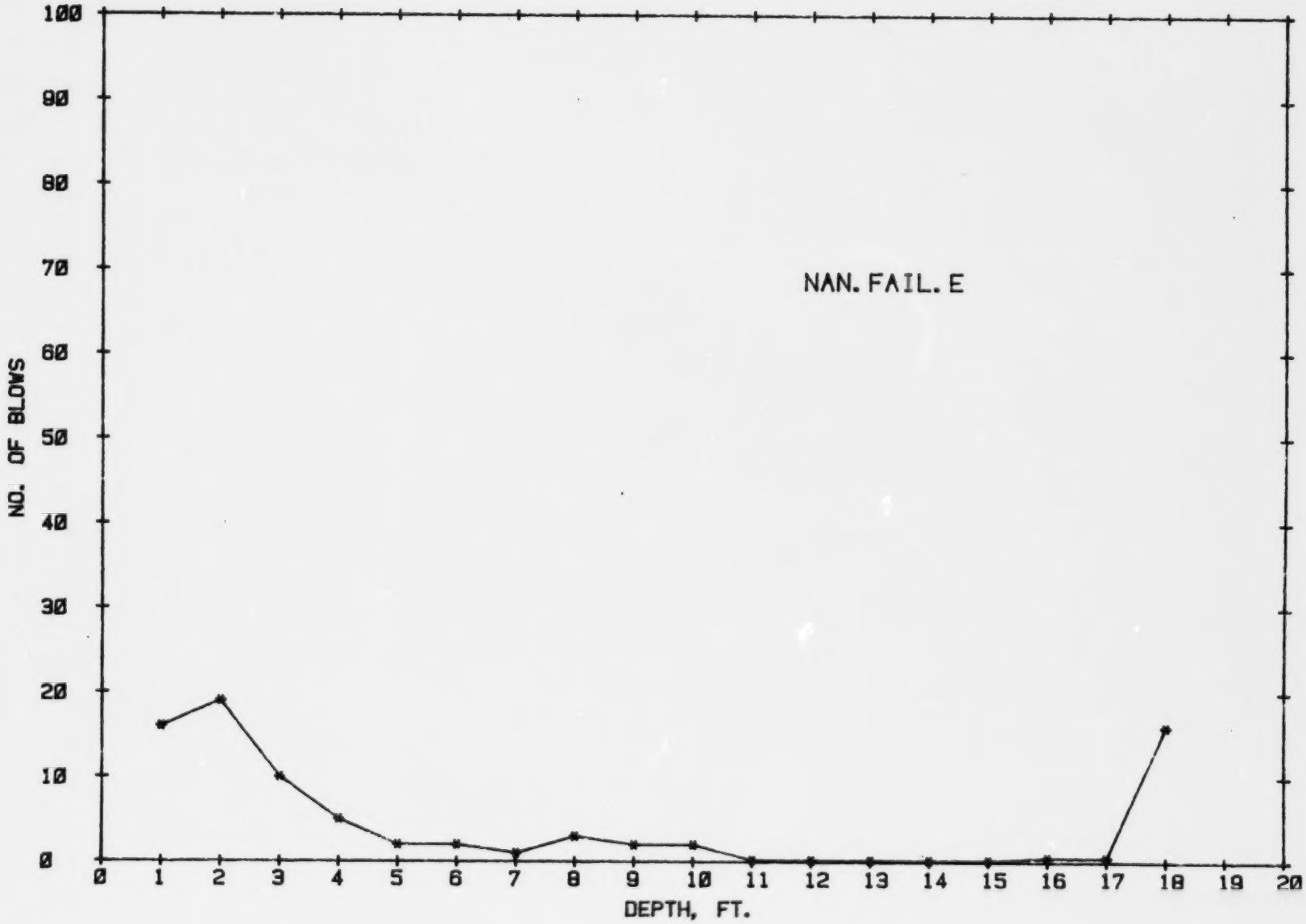
170183 RD

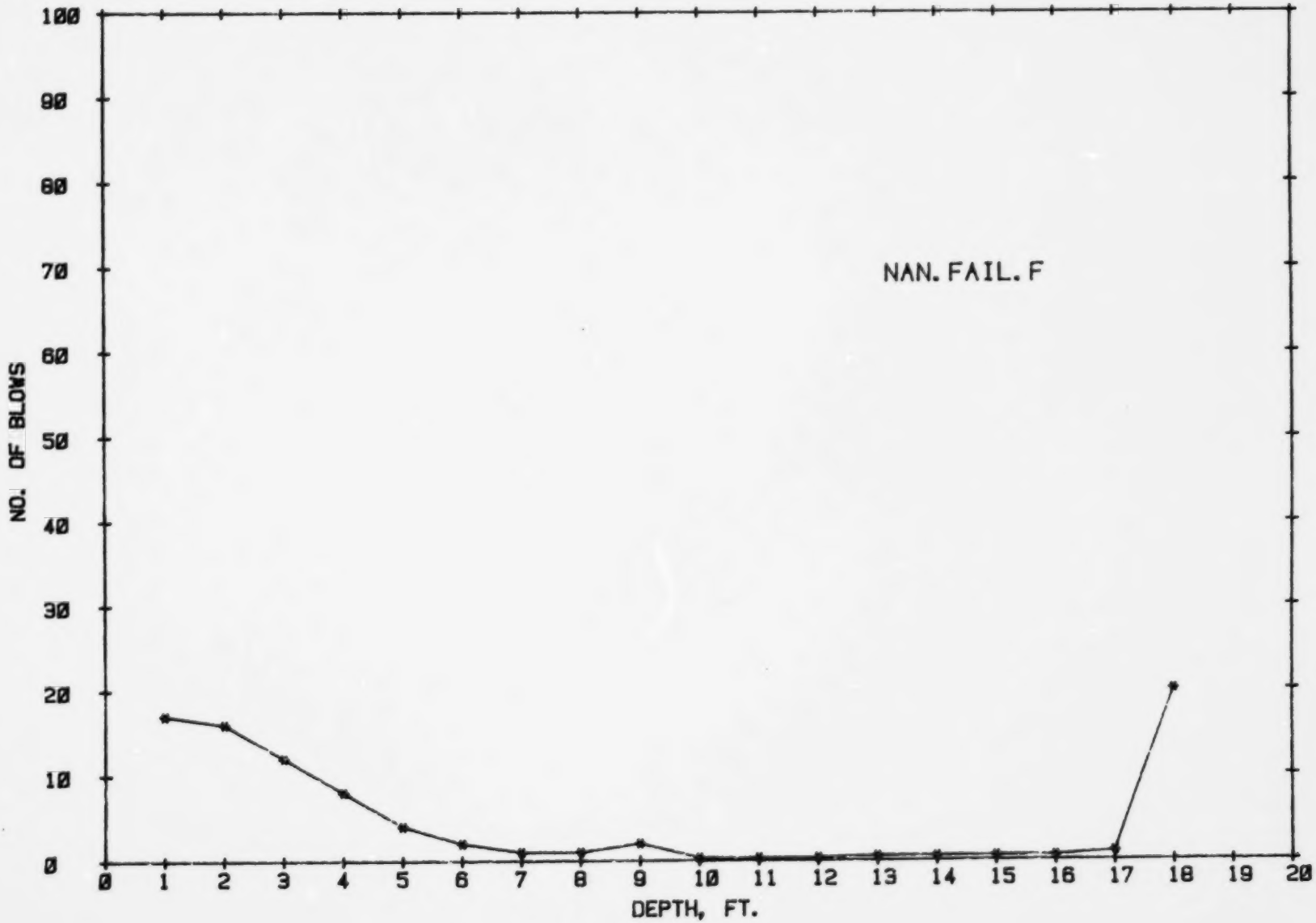

NAN. FAIL. A
NO. OF BLOWS
100
90
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.

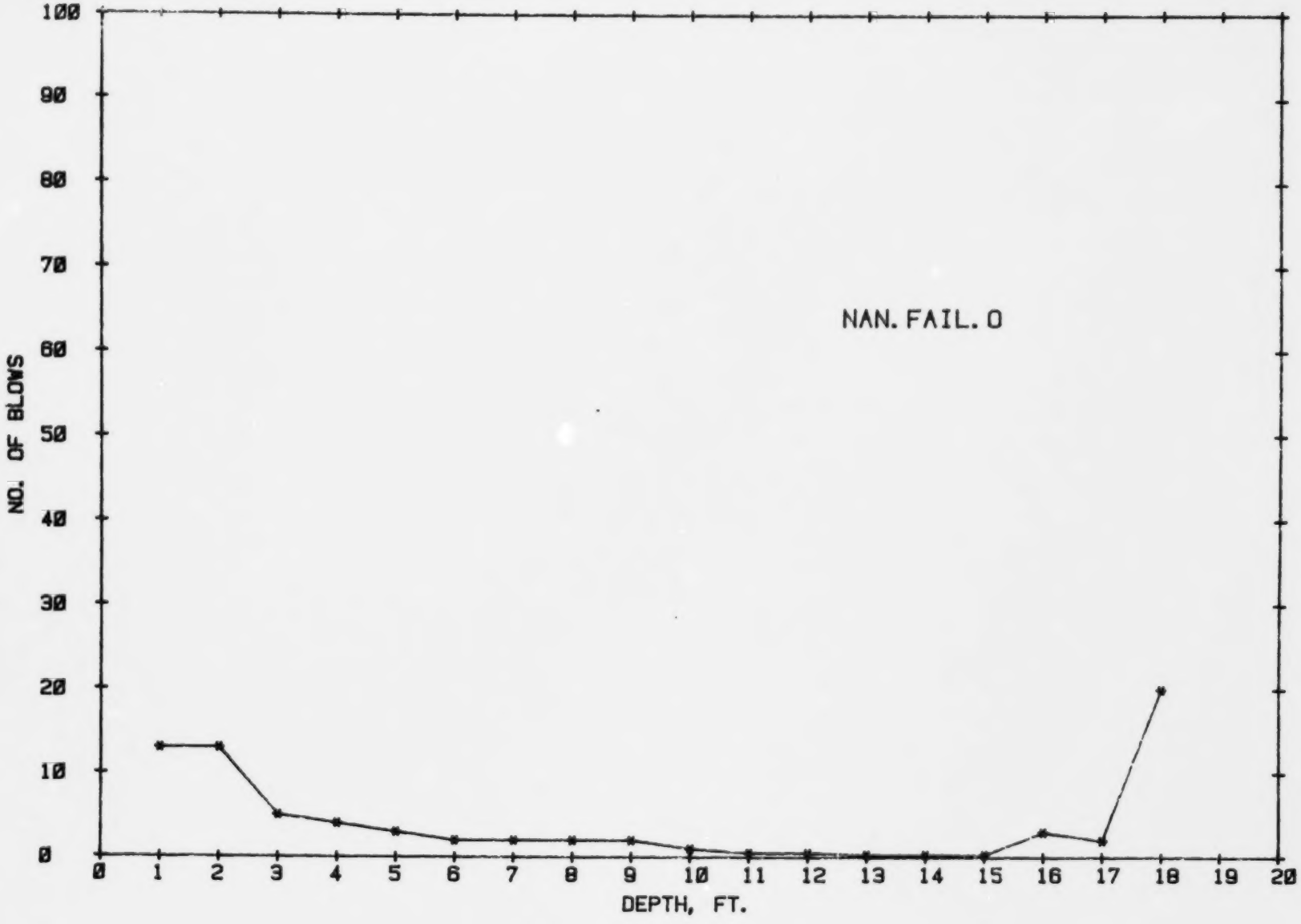

NAN. FAIL. B
NO. OF BLOWS
100
90
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.

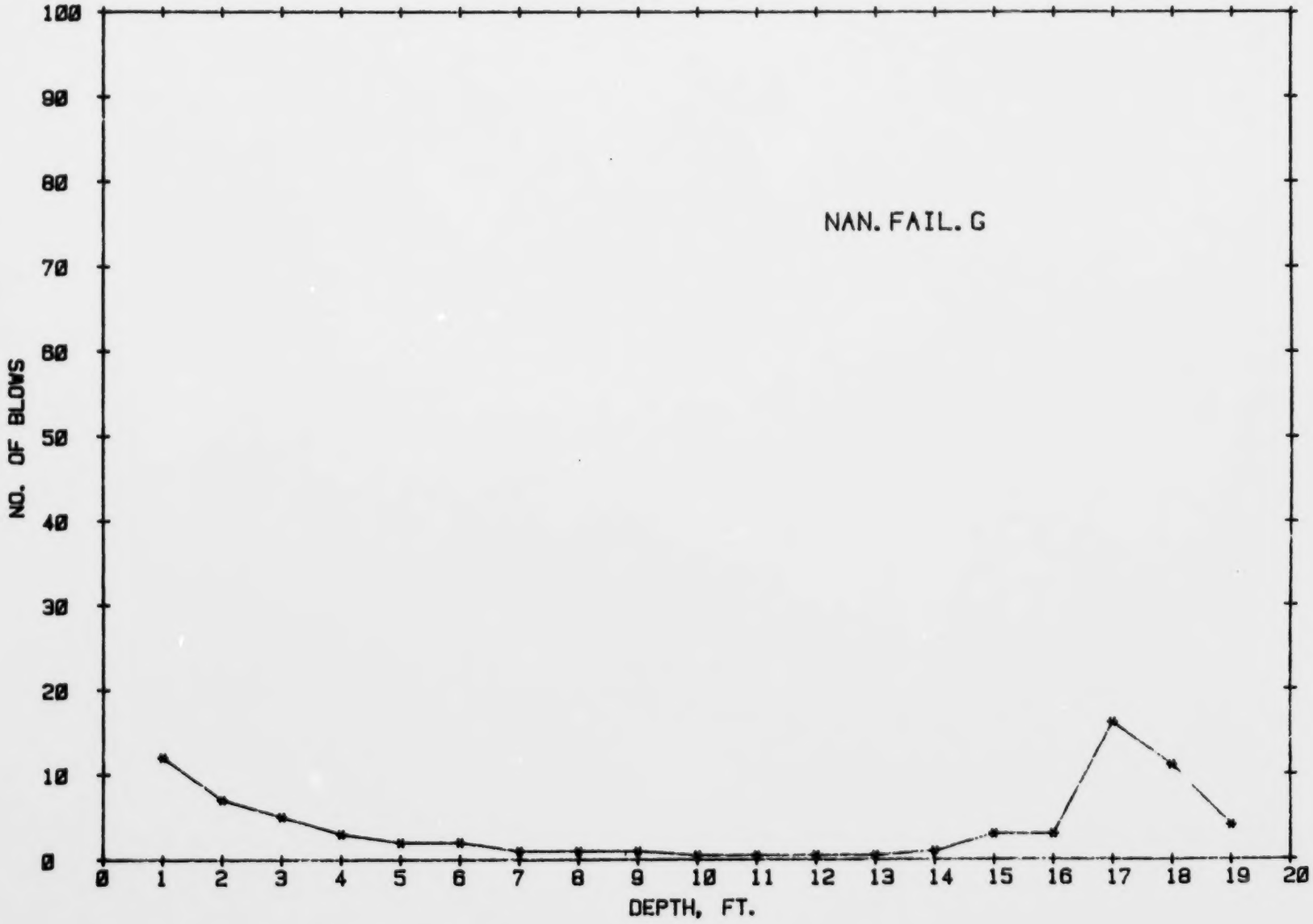

NAN. FAIL. C
NO. OF BLOWS
DEPTH, FT.
100
90
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

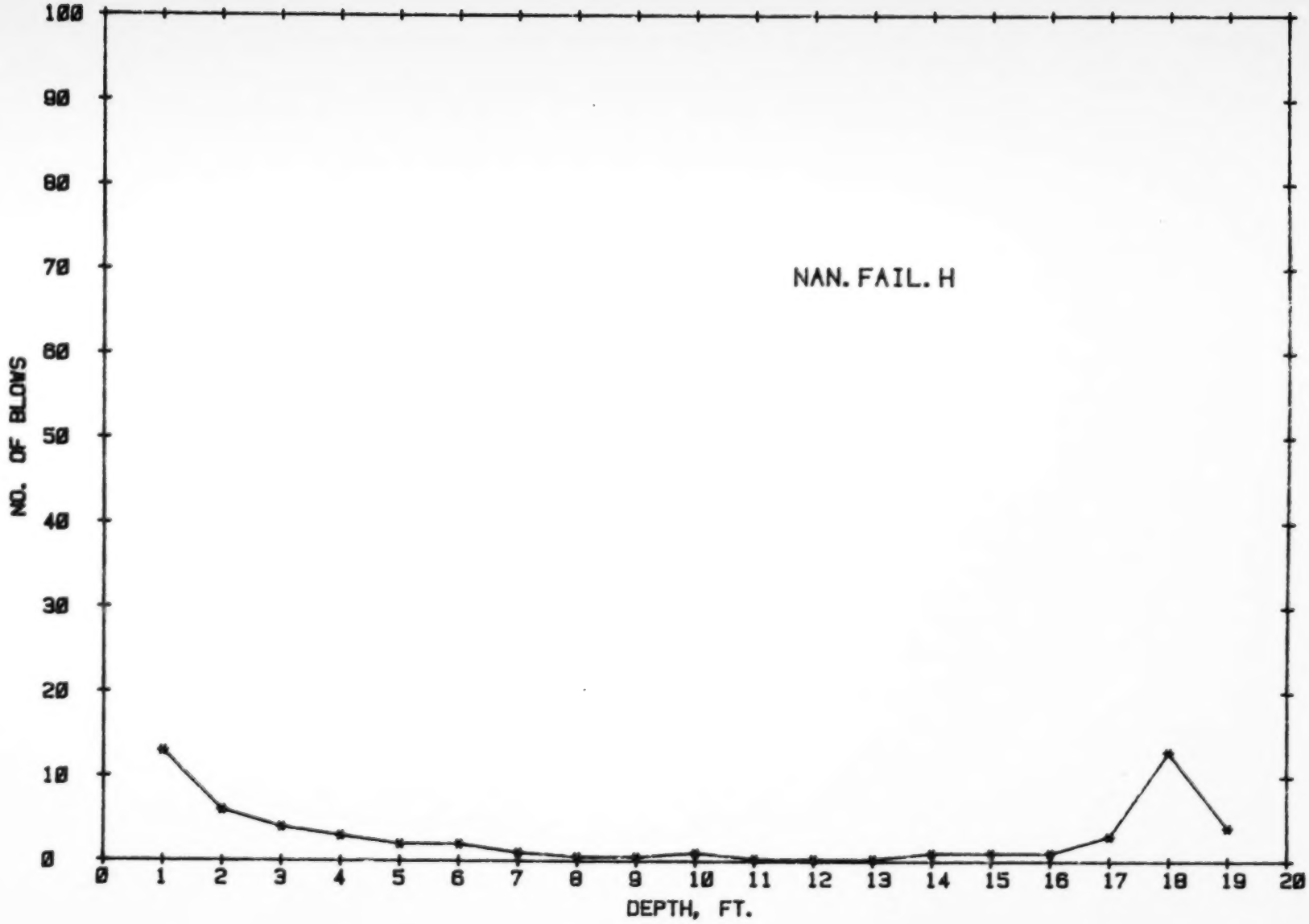

NAN. FAIL. D
NO. OF BLOWS
100
90
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.

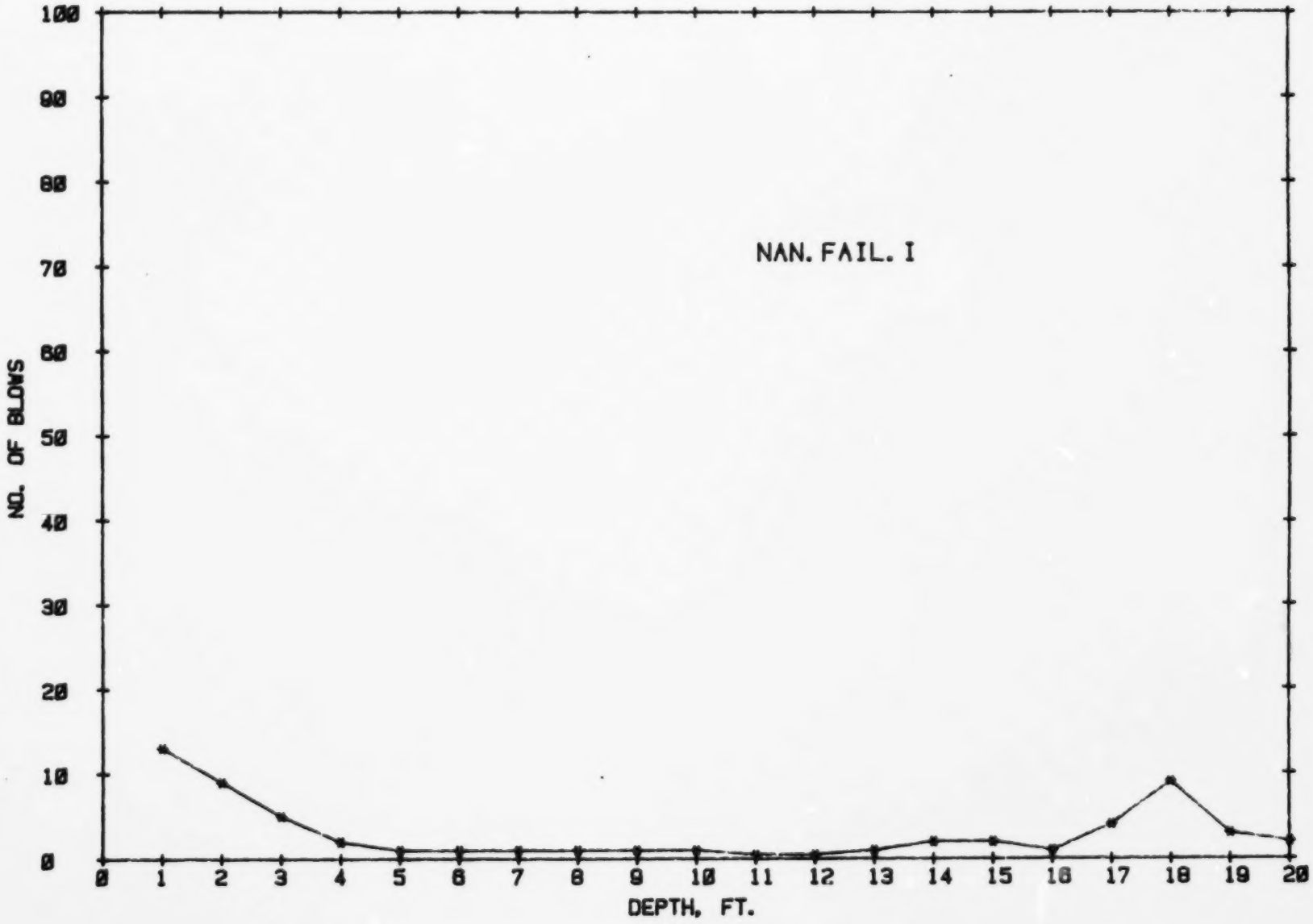

NAN. FAIL. E
NO. OF BLOWS
DEPTH, FT.
100
90
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

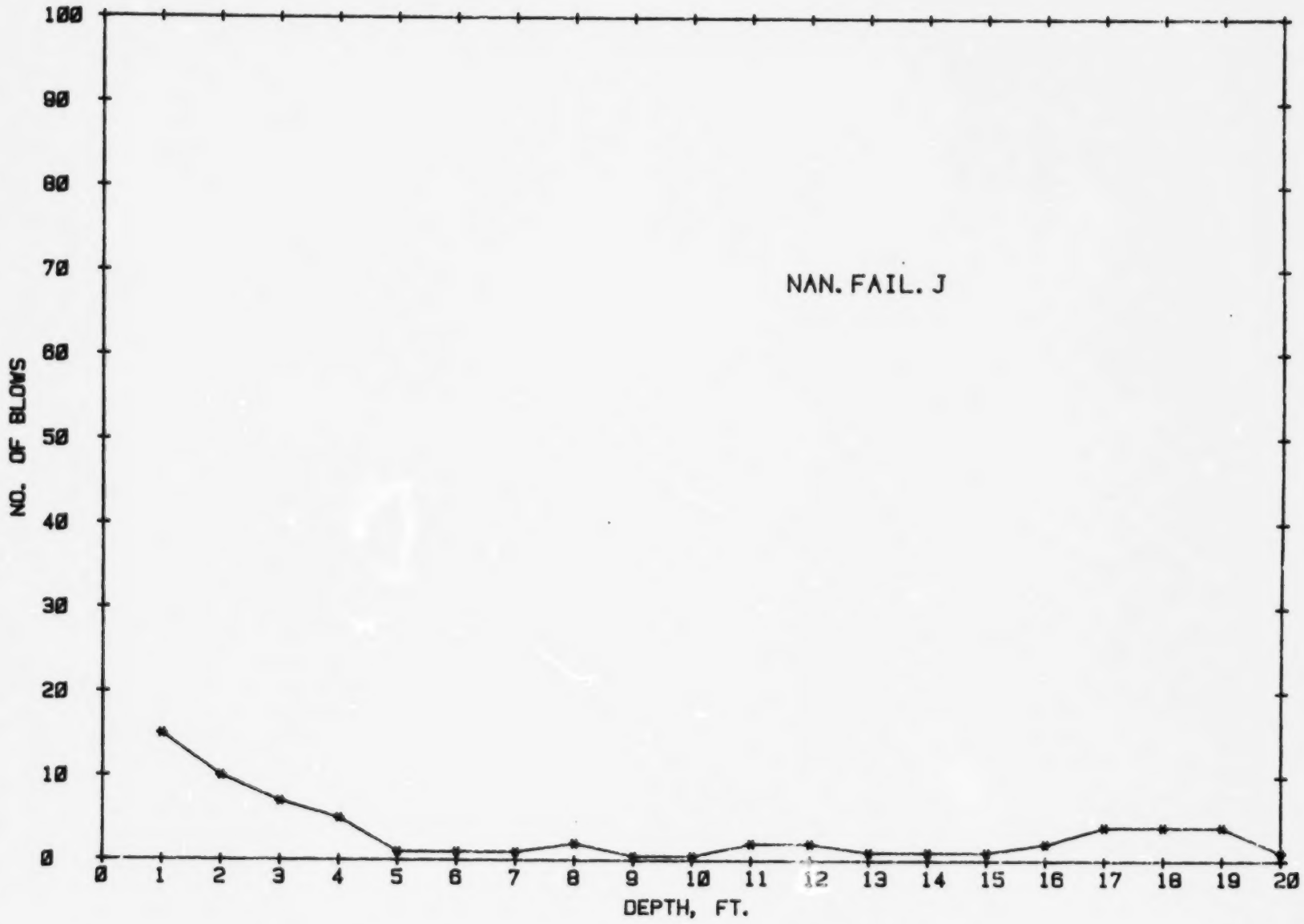

NAN. FAIL. F
NO. OF BLOWS
DEPTH, FT.
100
90
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

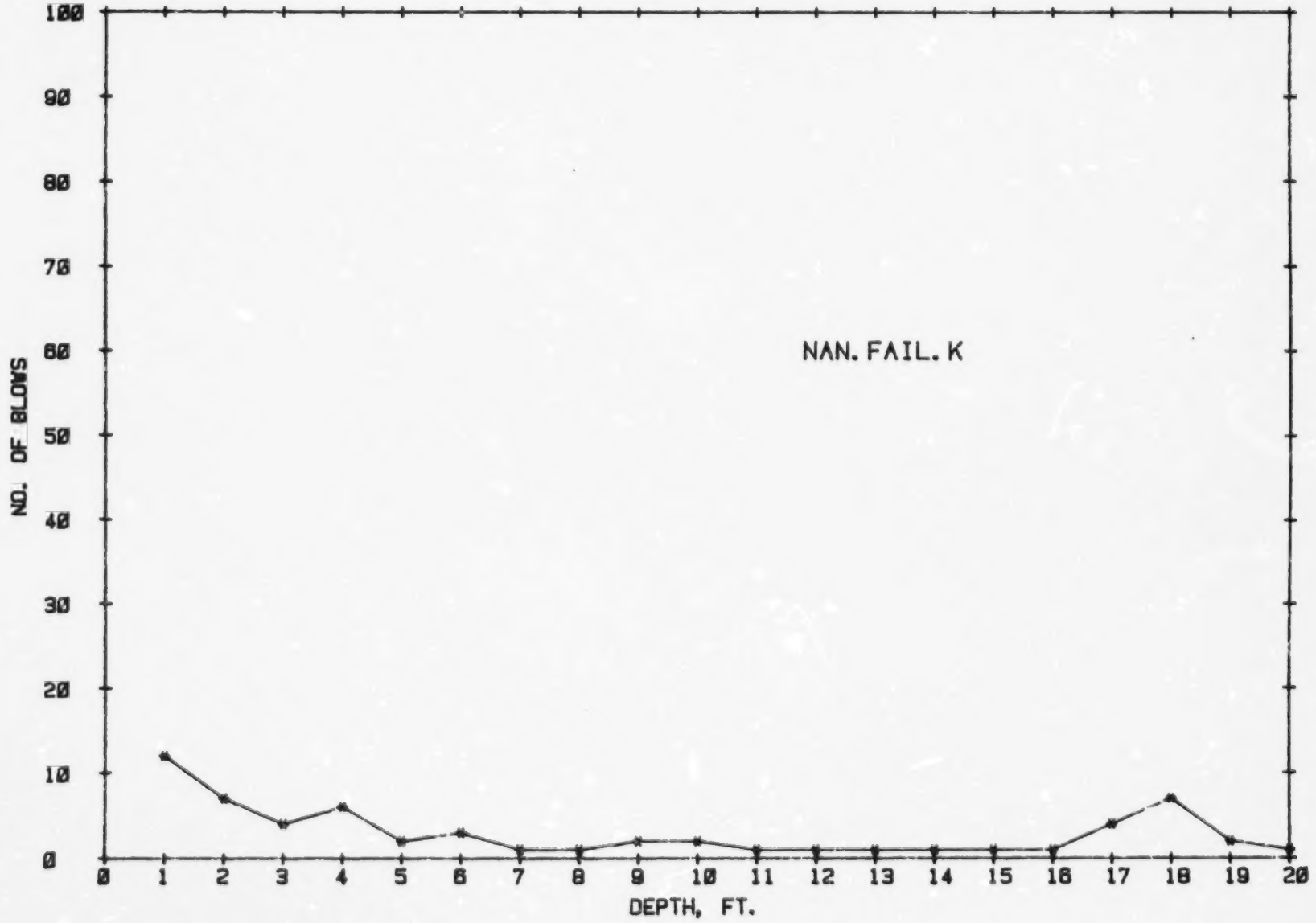

NAN. FAIL. 0
NO. OF BLOWS
100
90
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.

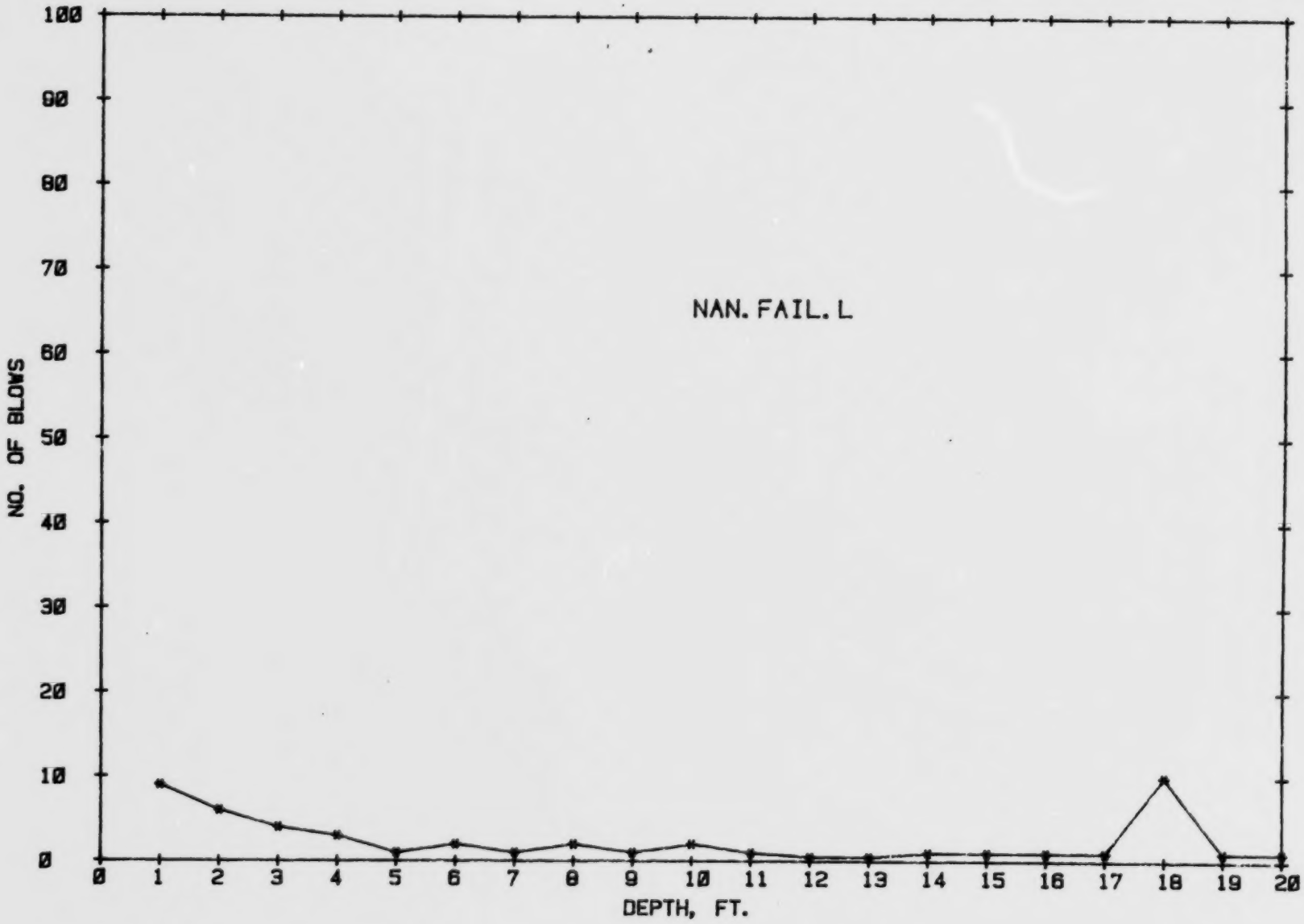

NAN. FAIL. G
NO. OF BLOWS
DEPTH, FT.
0
10
20
30
40
50
60
70
80
90
100
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

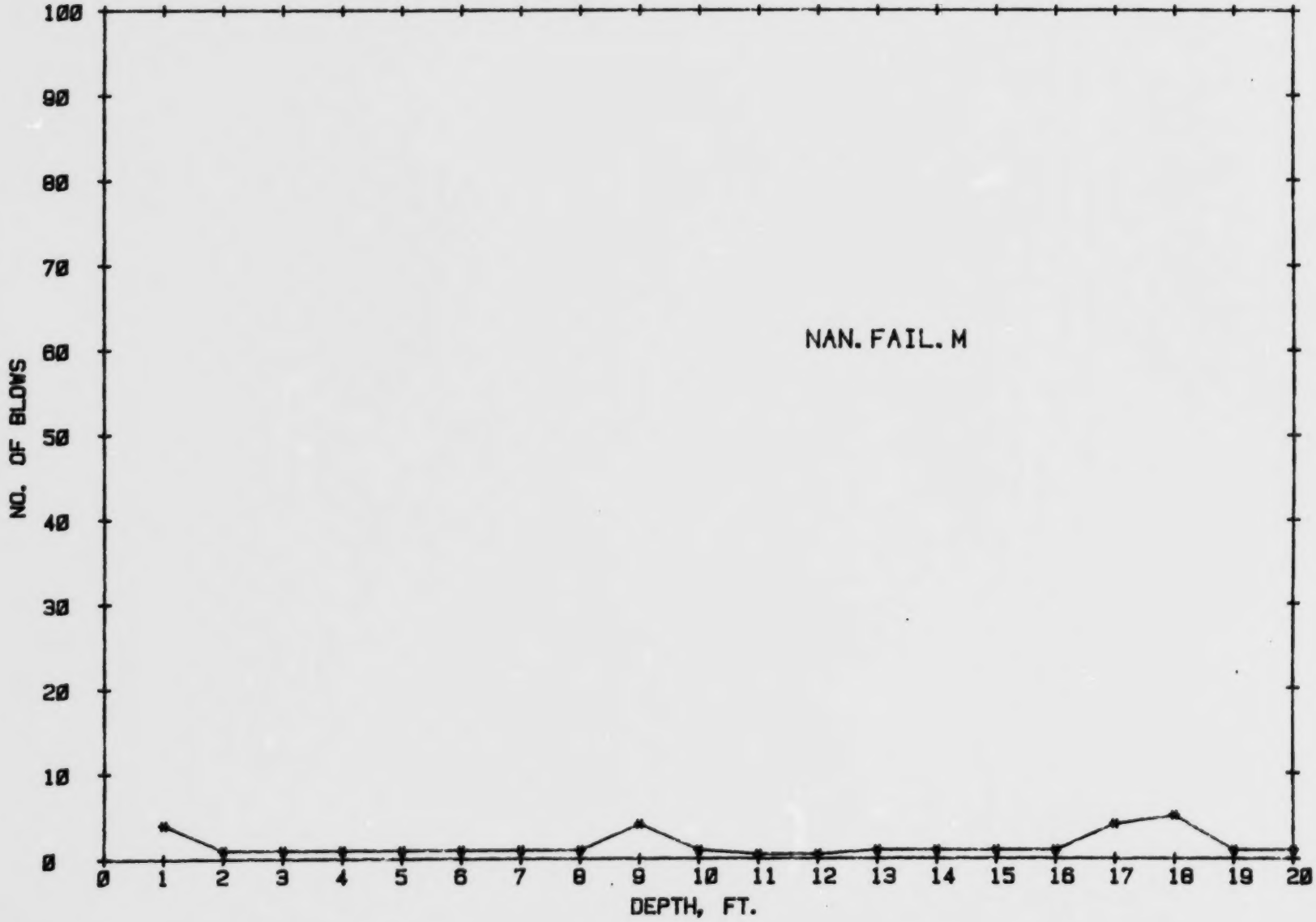

NAN. FAIL. H
NO. OF BLOWS
DEPTH, FT.
100
90
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

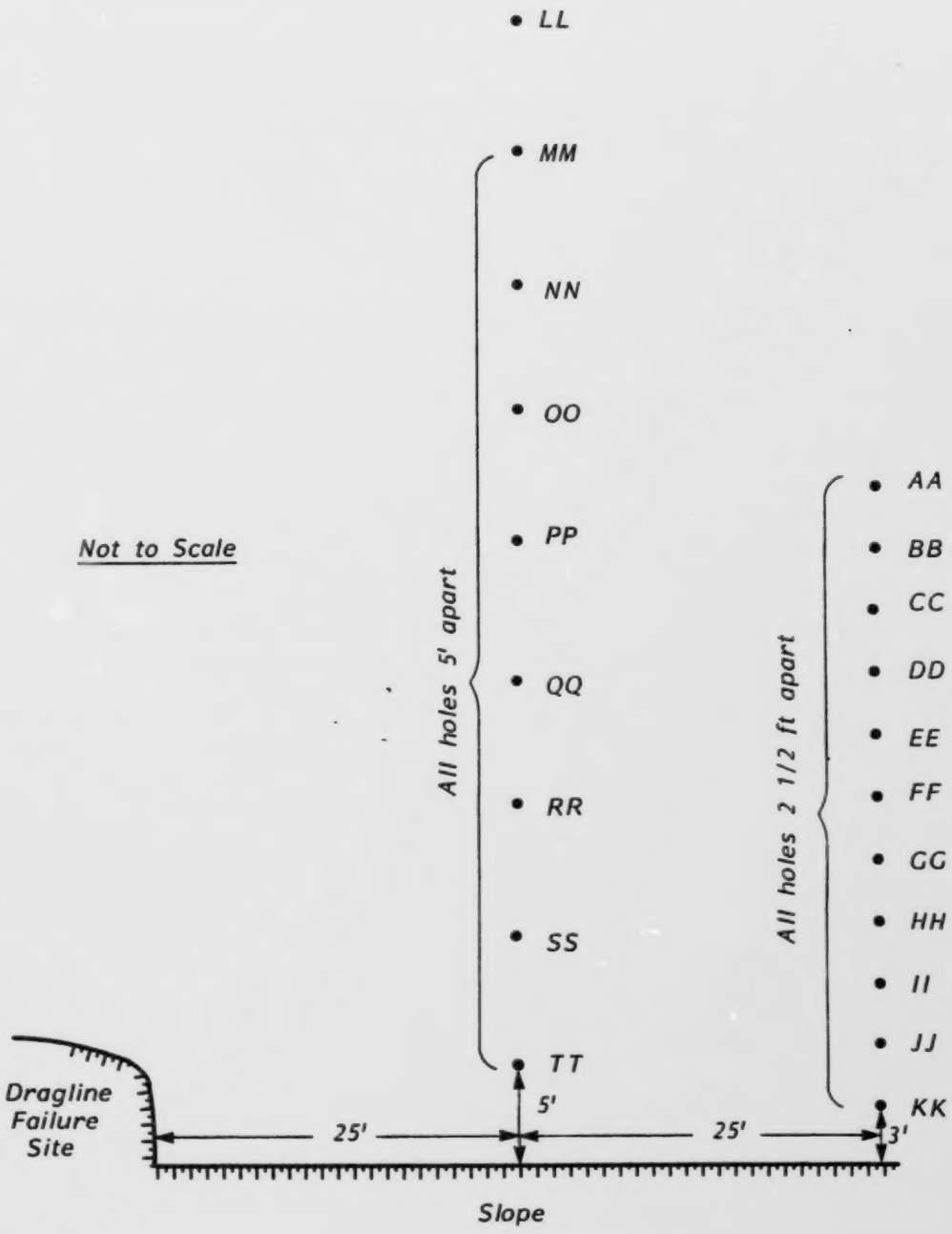

NAN. FAIL. I
NO. OF BLOWS
100
90
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. FAIL. J
NO. OF BLOWS
DEPTH, FT.
100
90
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

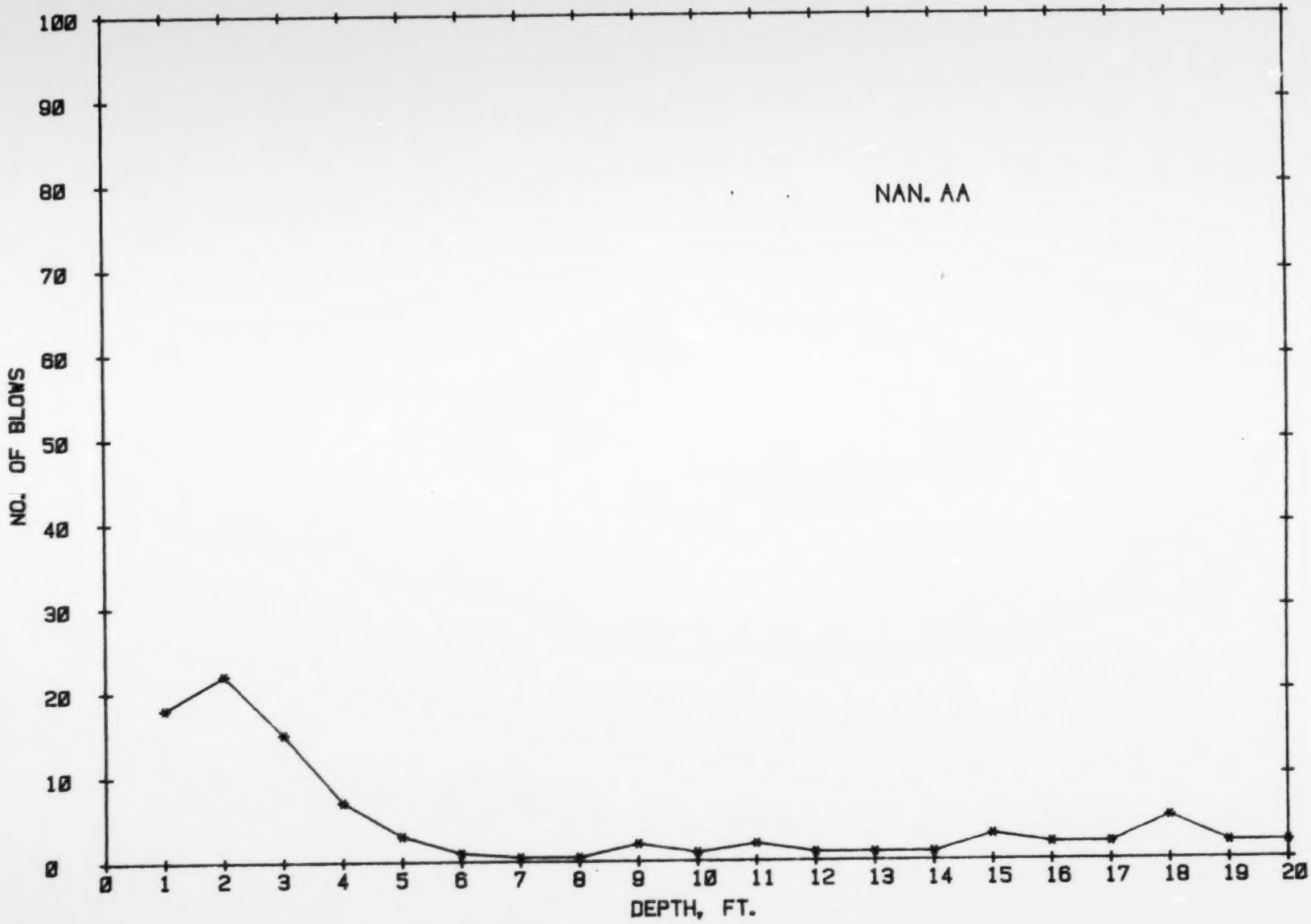

100
90
80
70
60
50
40
30
20
10
0
NO. OF BLOWS
NAN. FAIL. K
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.

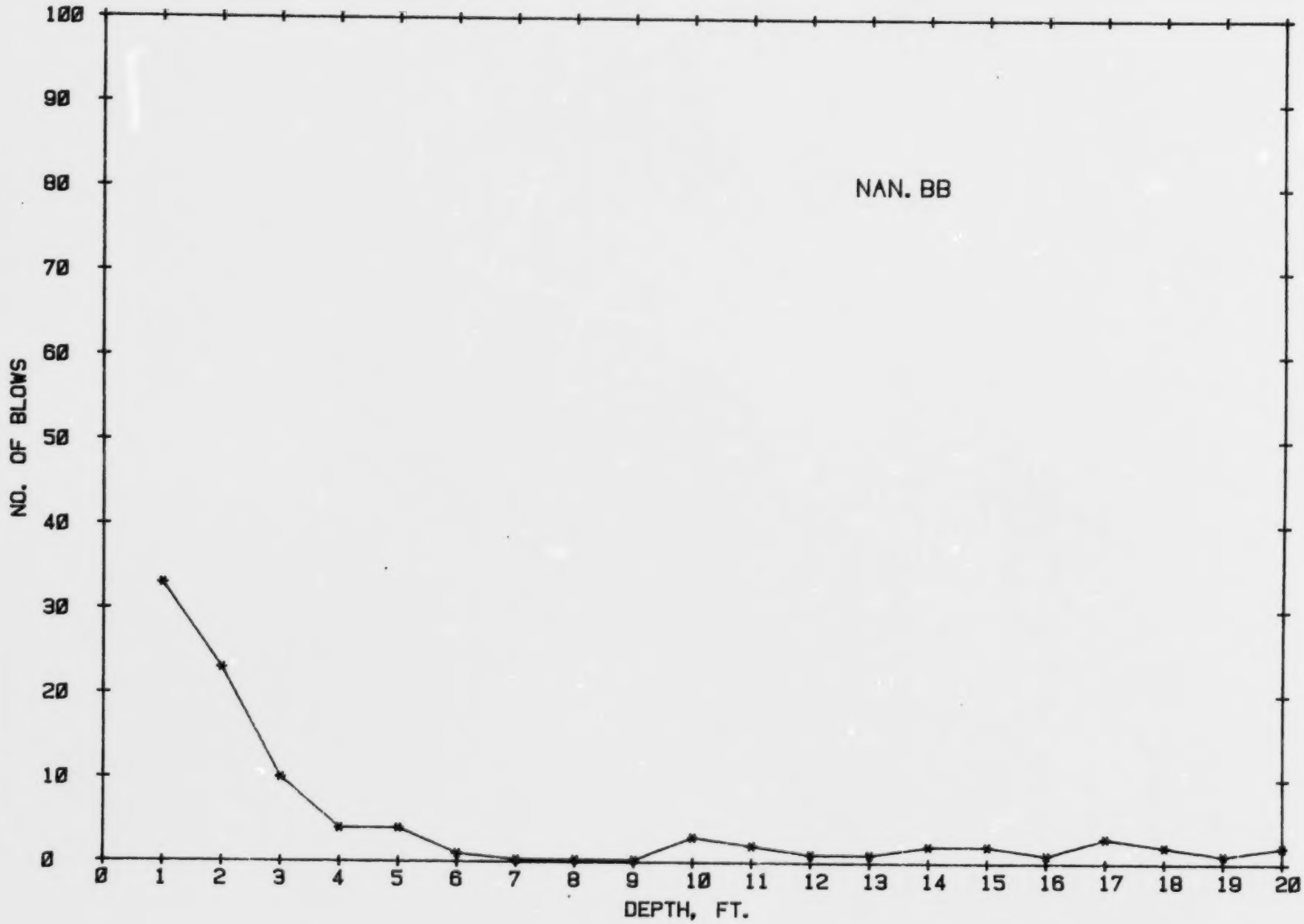

NAN. FAIL. L
NO. OF BLOWS
DEPTH, FT.
100
90
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20


NAN. FAIL. M
NO. OF BLOWS
DEPTH, FT.
100
90
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20


LL
MM
NN
OO
PP
QQ
RR
SS
TT
AA
BB
CC
DD
EE
FF
GG
HH
II
JJ
KK
Not to Scale
All holes 5' apart
All holes 2 1/2 ft apart
Dragline Failure Site
25'
5'
25'
3'
Slope

170184 RD


NAN. AA
NO. OF BLOWS
100
90
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. BB
NO. OF BLOWS
100
90
80
70
60
50
40
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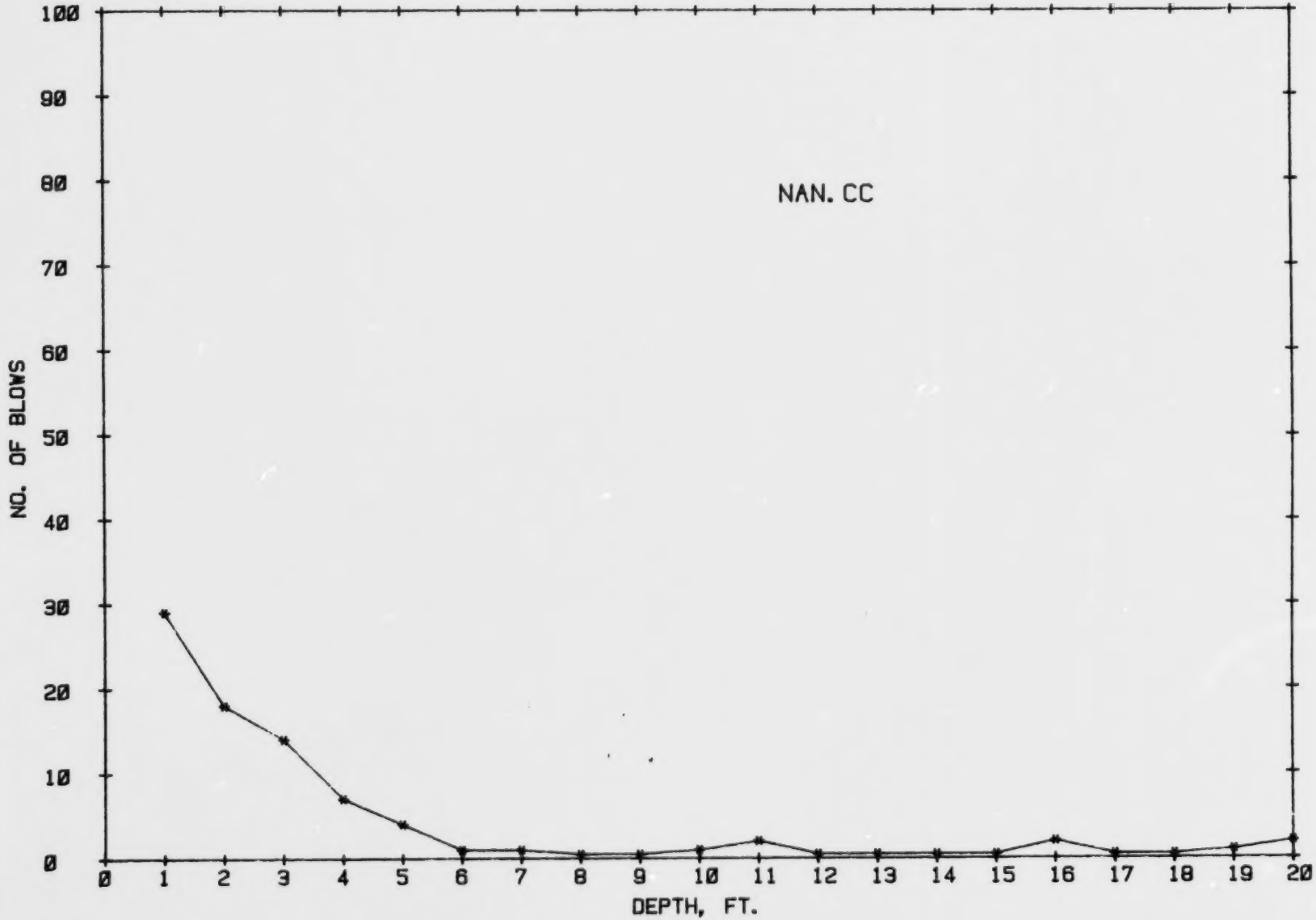
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. CC
NO. OF BLOWS
DEPTH, FT.
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20
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0
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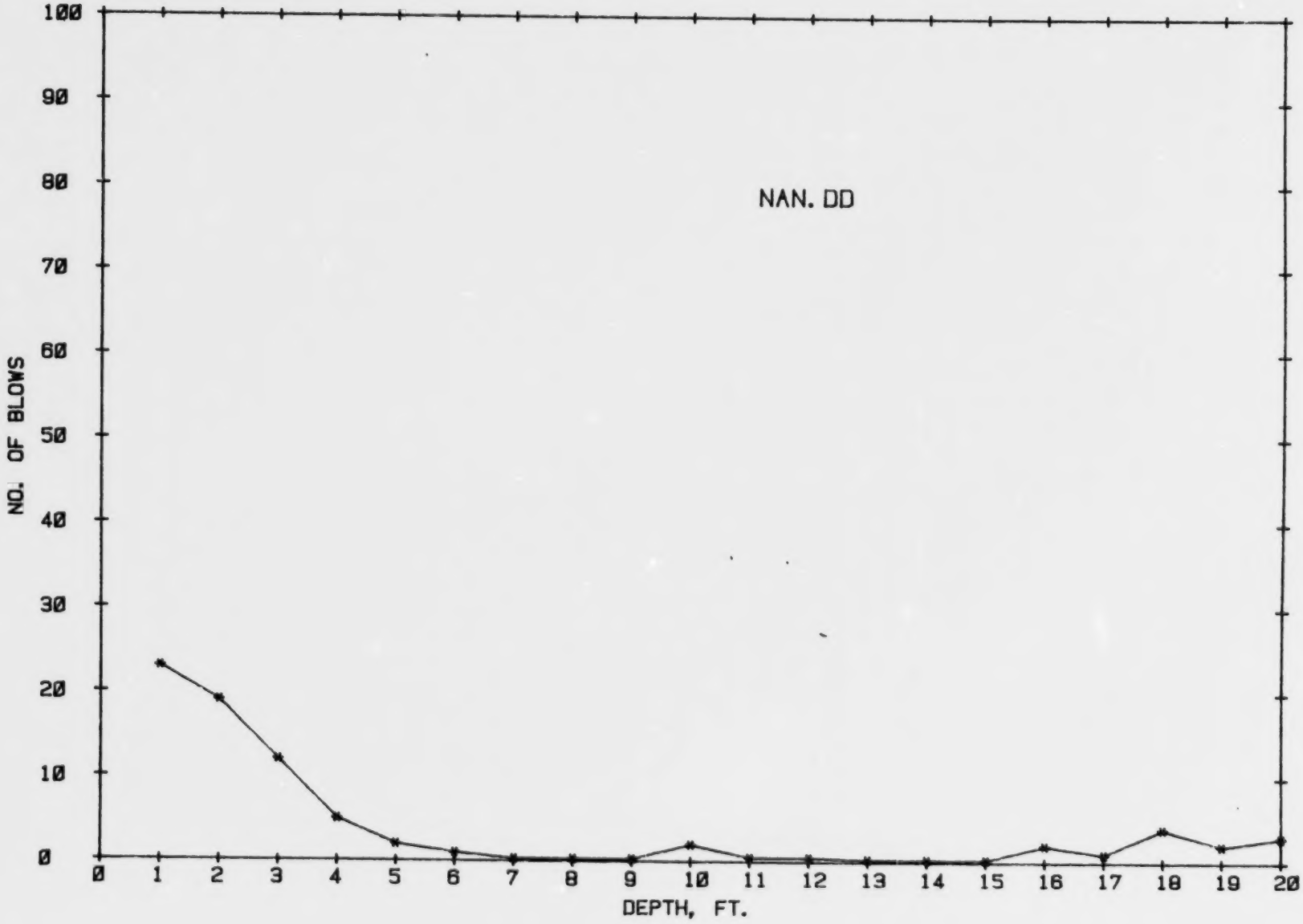
NAN. DD
NO. OF BLOWS
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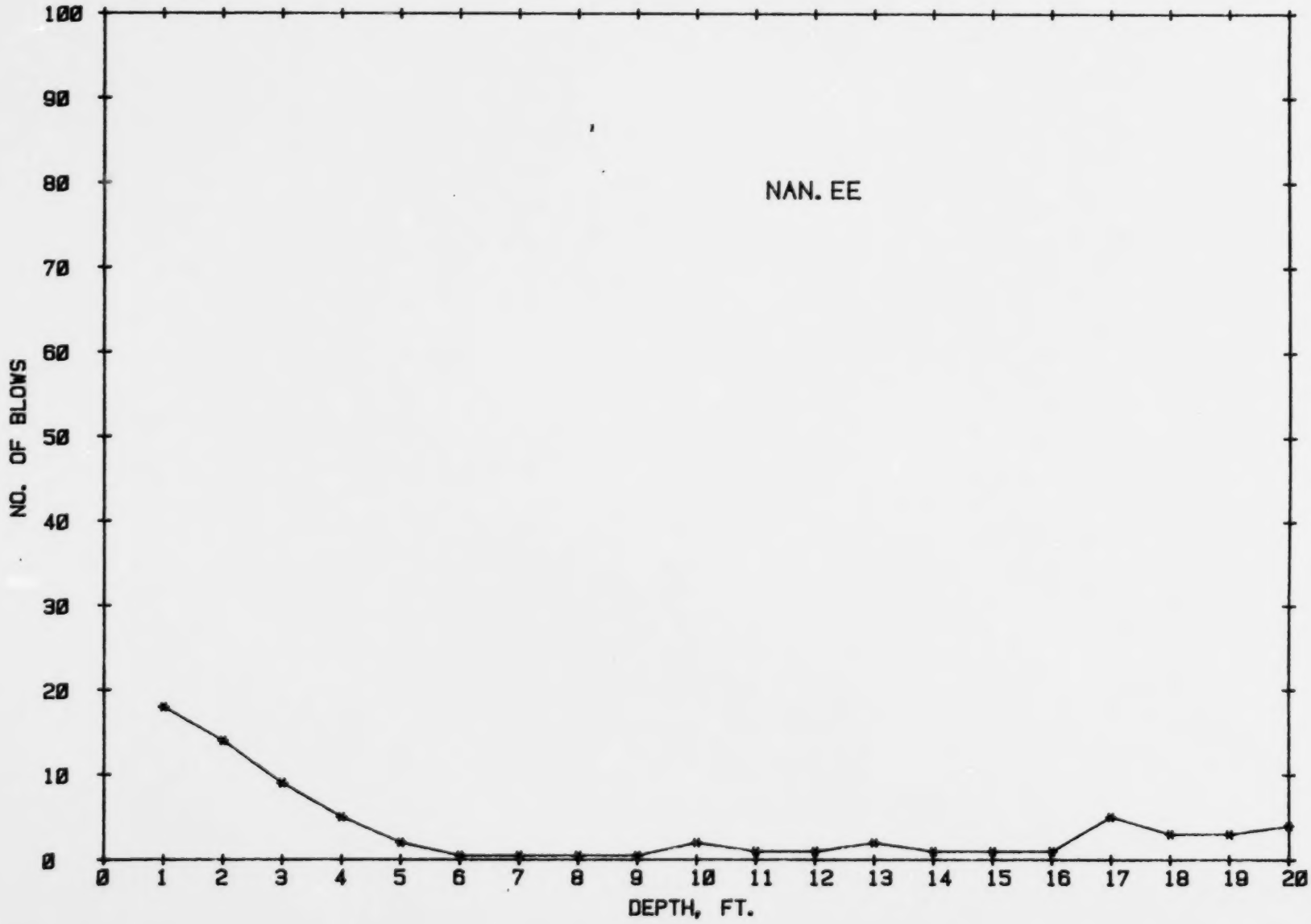
DEPTH, FT.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NO. OF BLOWS
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0
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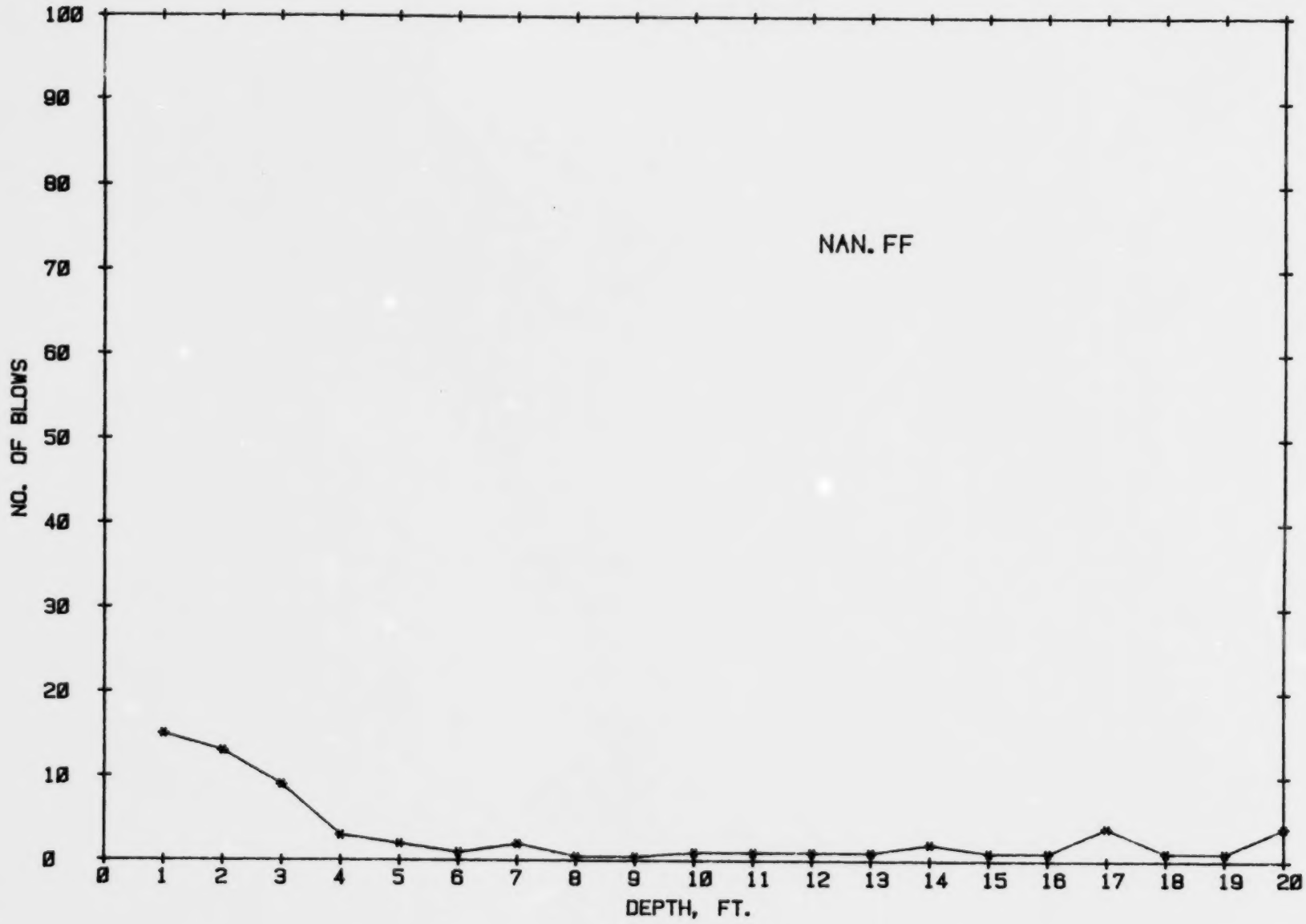
DEPTH, FT.


NAN. FF
NO. OF BLOWS
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20
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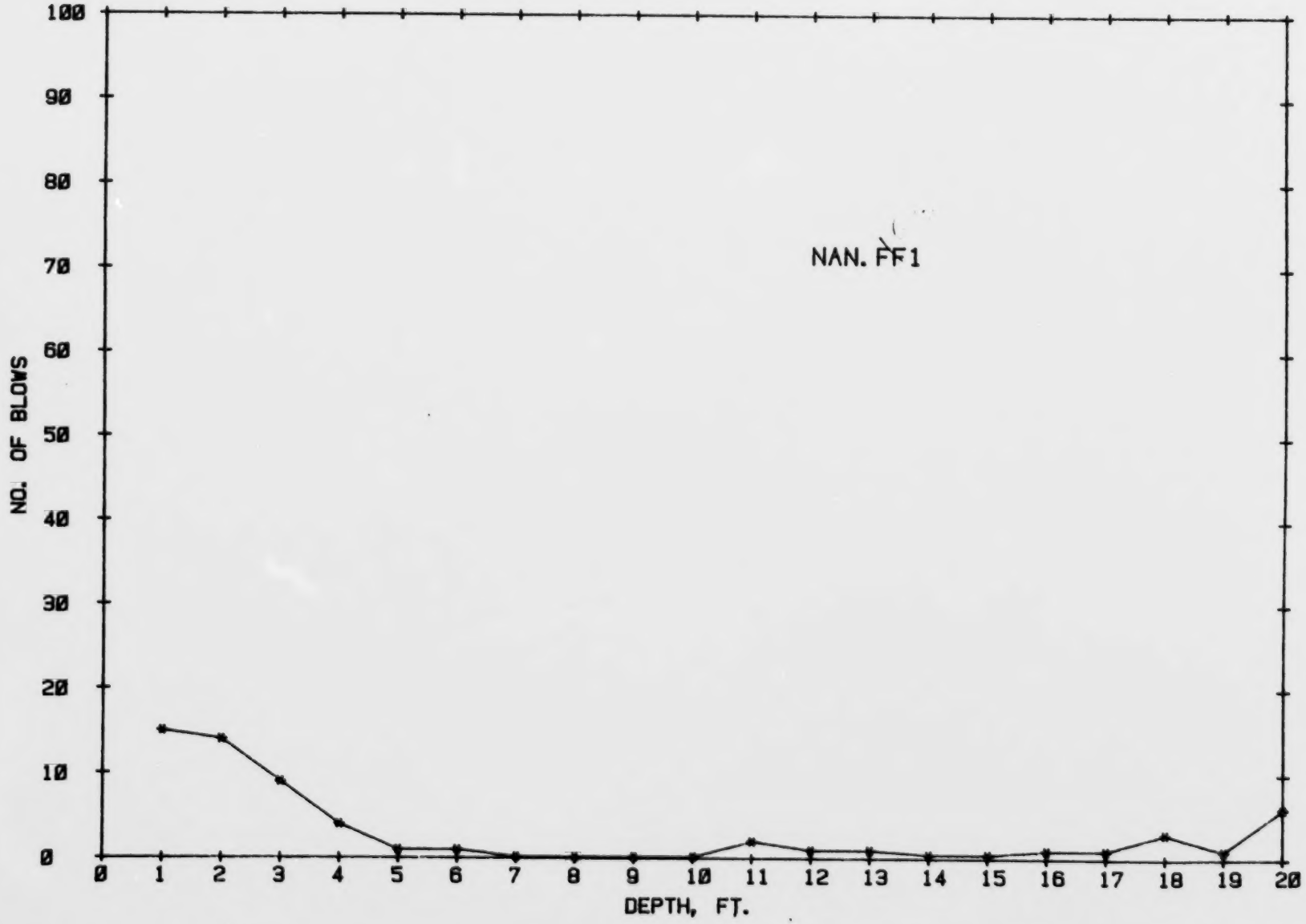
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. FF1
NO. OF BLOWS
DEPTH, FT.
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80
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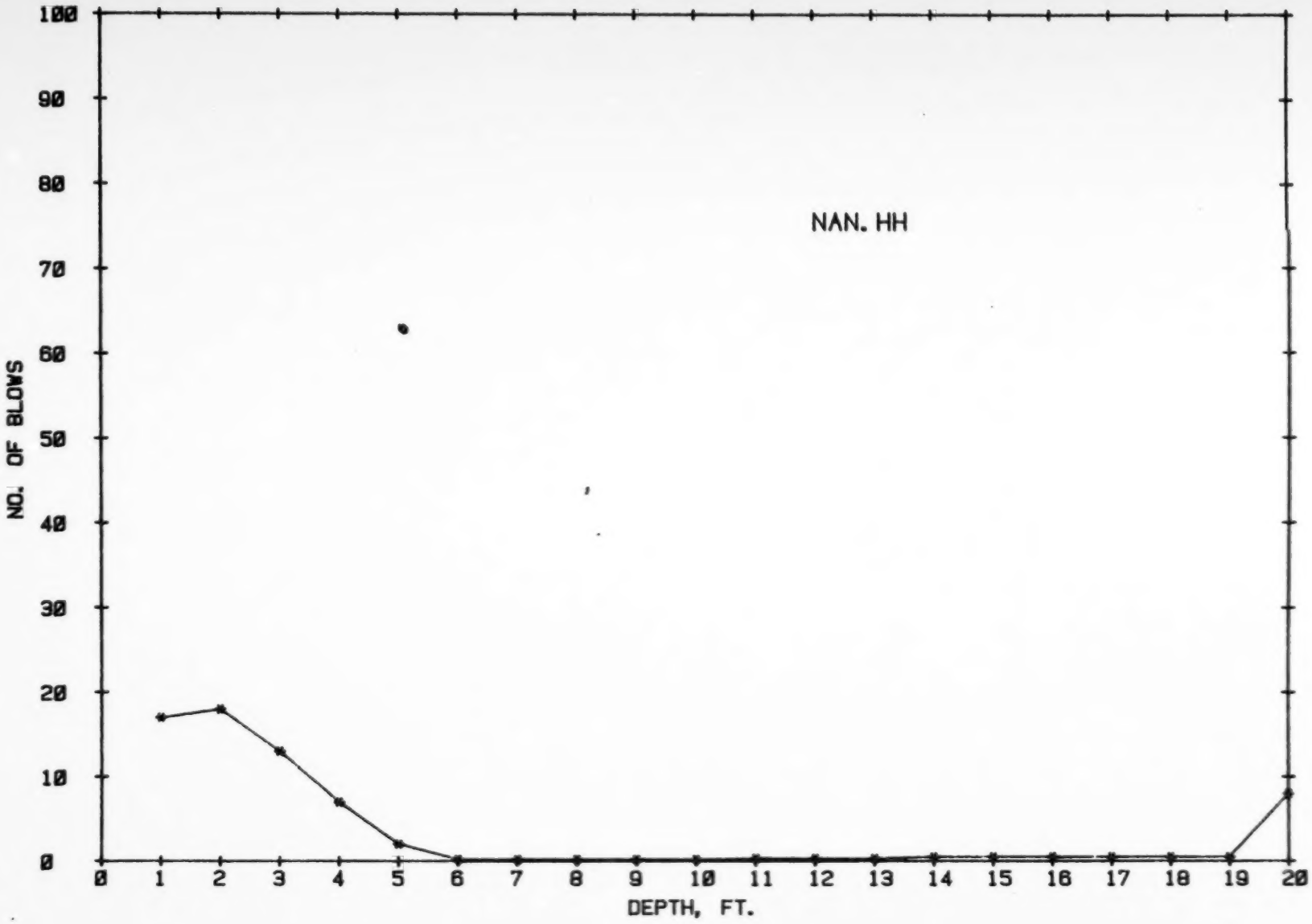
100
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20


NAN. HH
NO. OF BLOWS
DEPTH, FT.
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0
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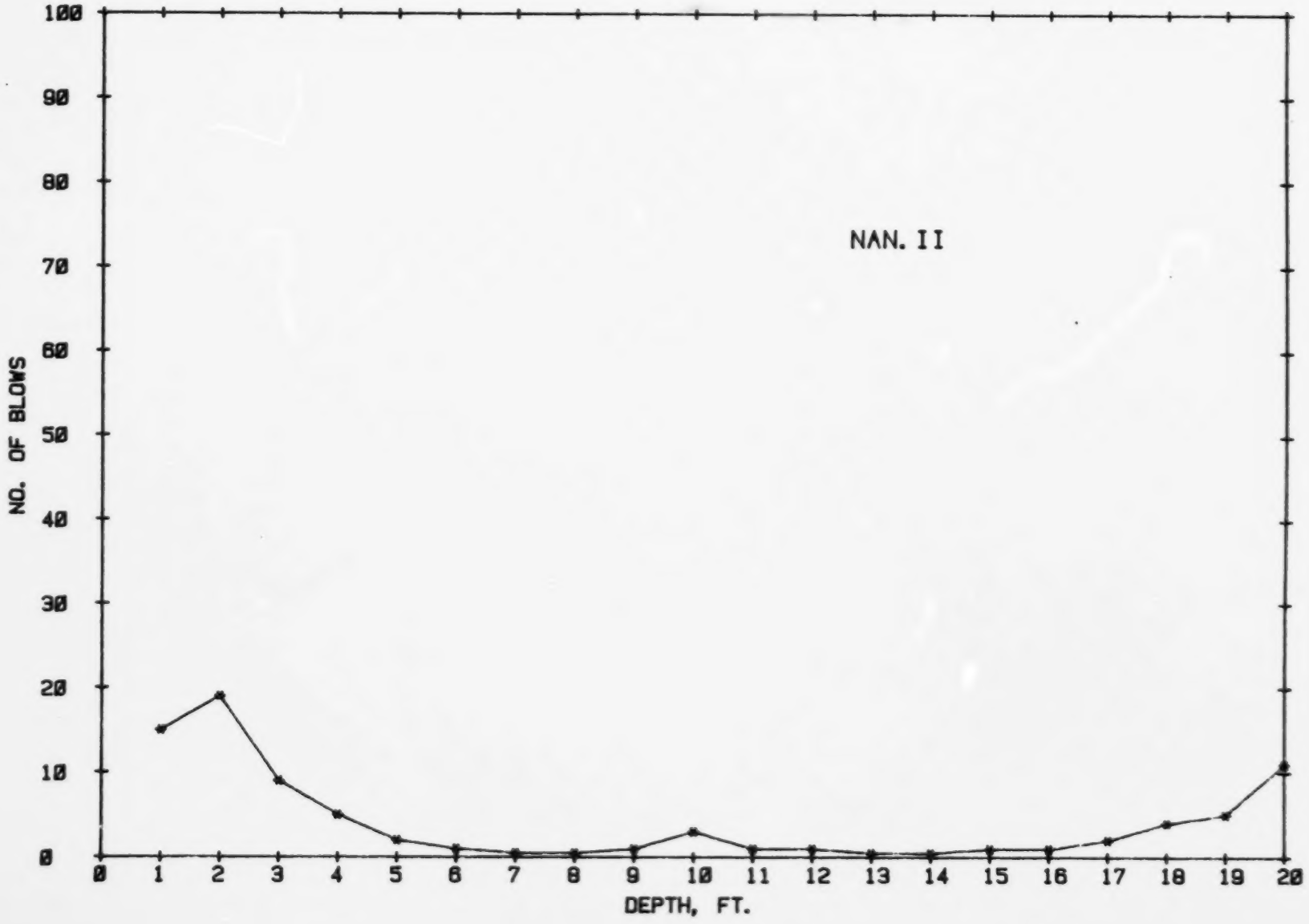
NAN. II
NO. OF BLOWS
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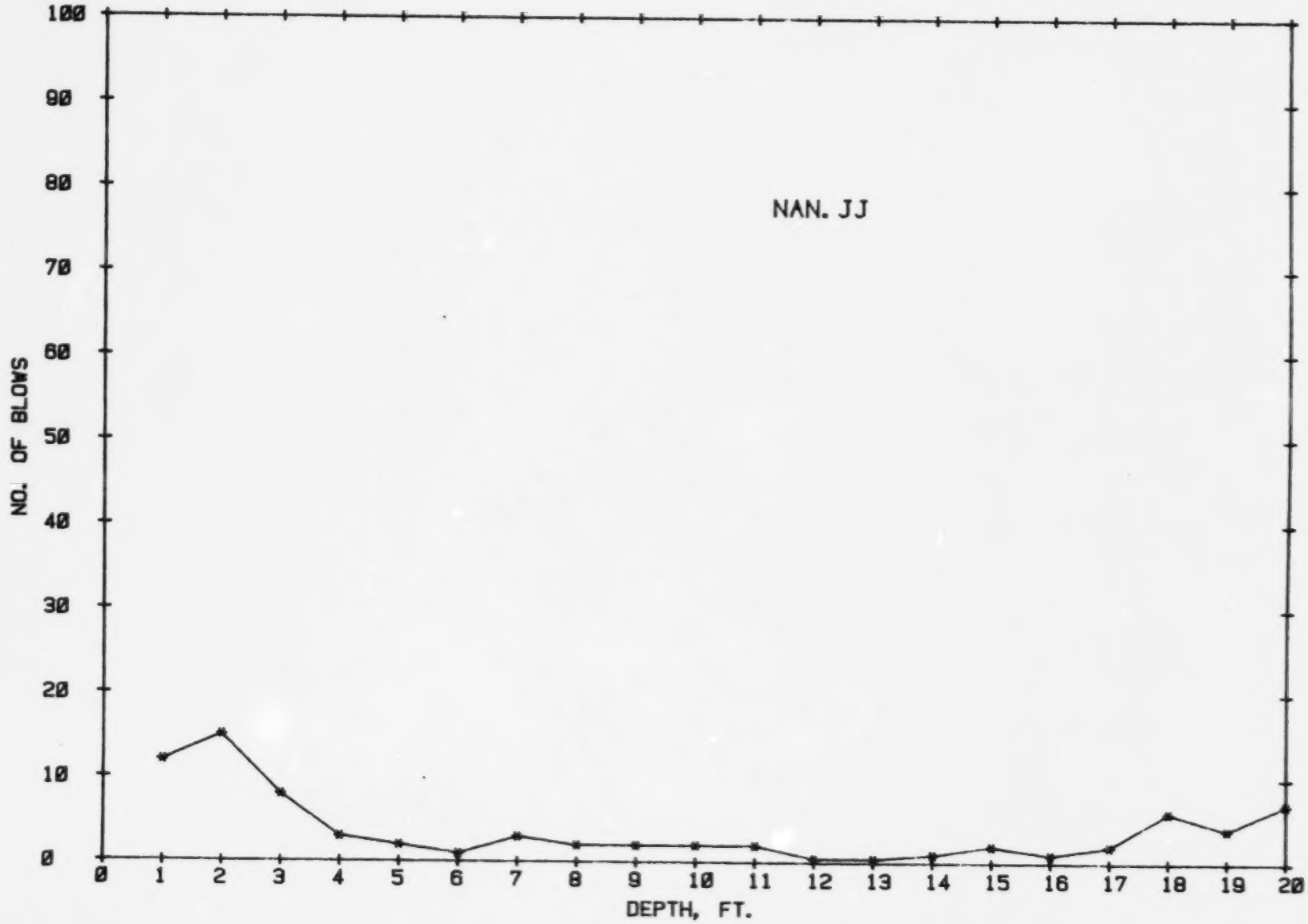
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. JJ
NO. OF BLOWS
DEPTH, FT.
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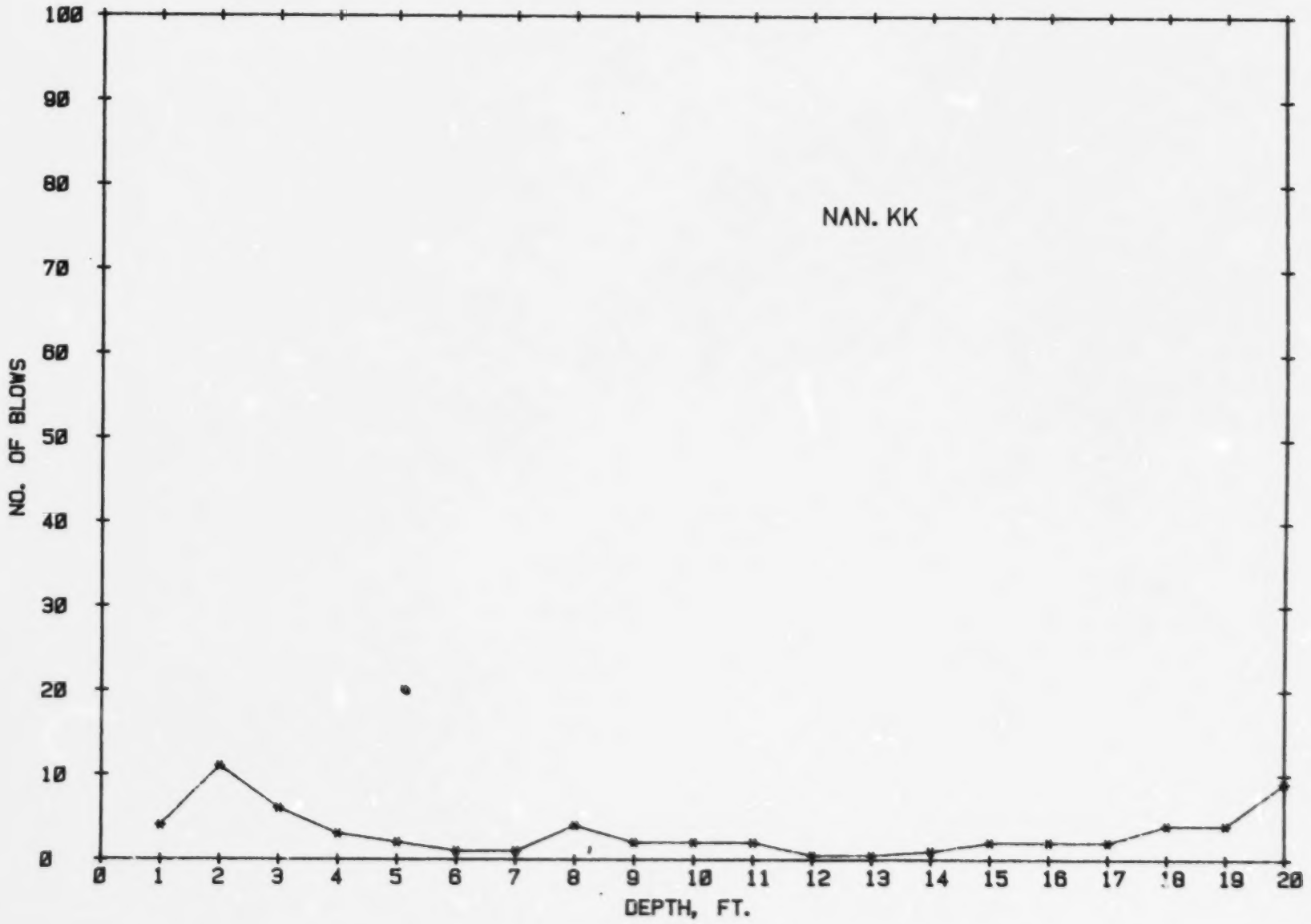
NAN. KK
NO. OF BLOWS
DEPTH, FT.
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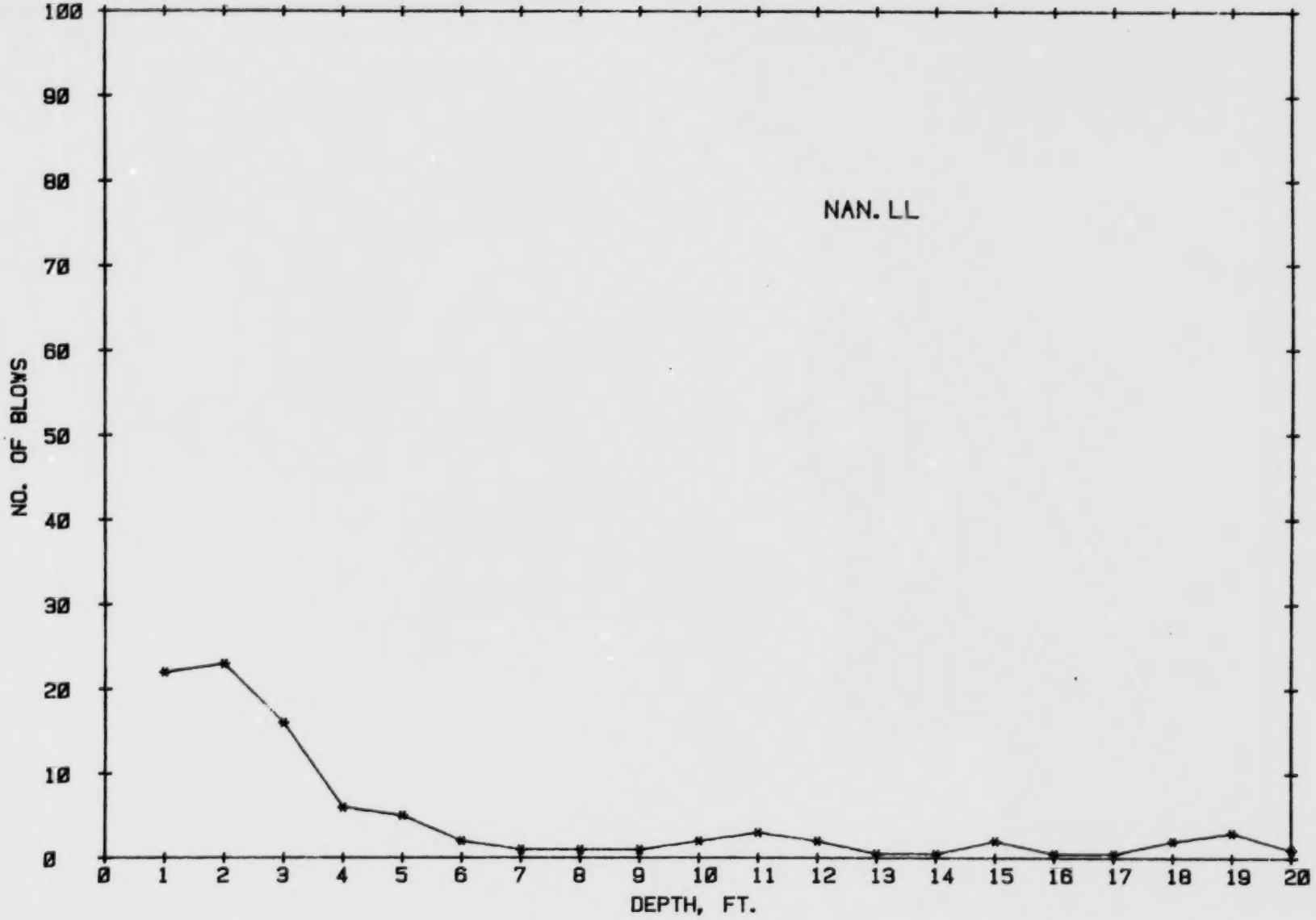
NAN. LL
NO. OF BLOWS
DEPTH, FT.
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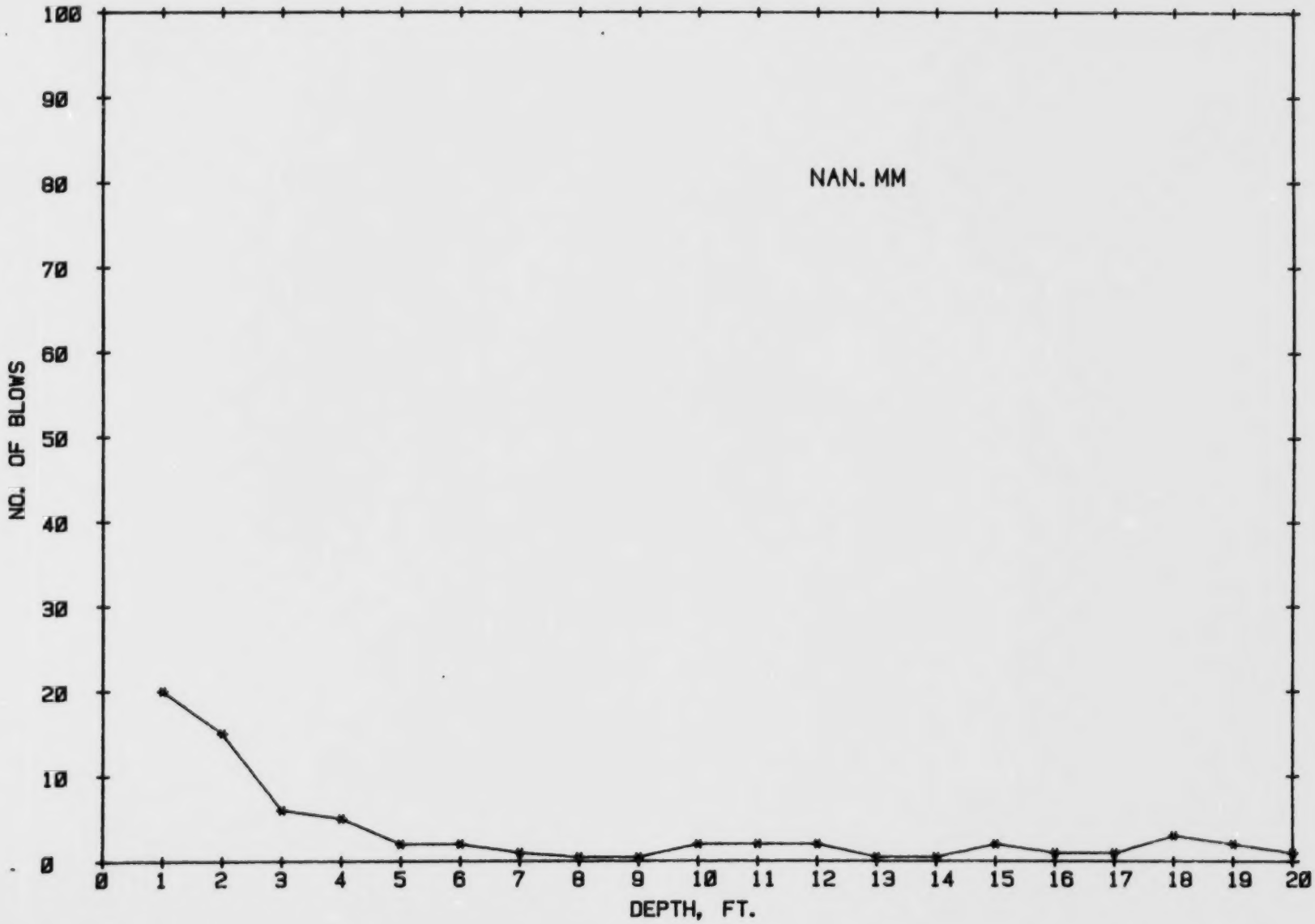
NAN. MM
NO. OF BLOWS
DEPTH, FT.
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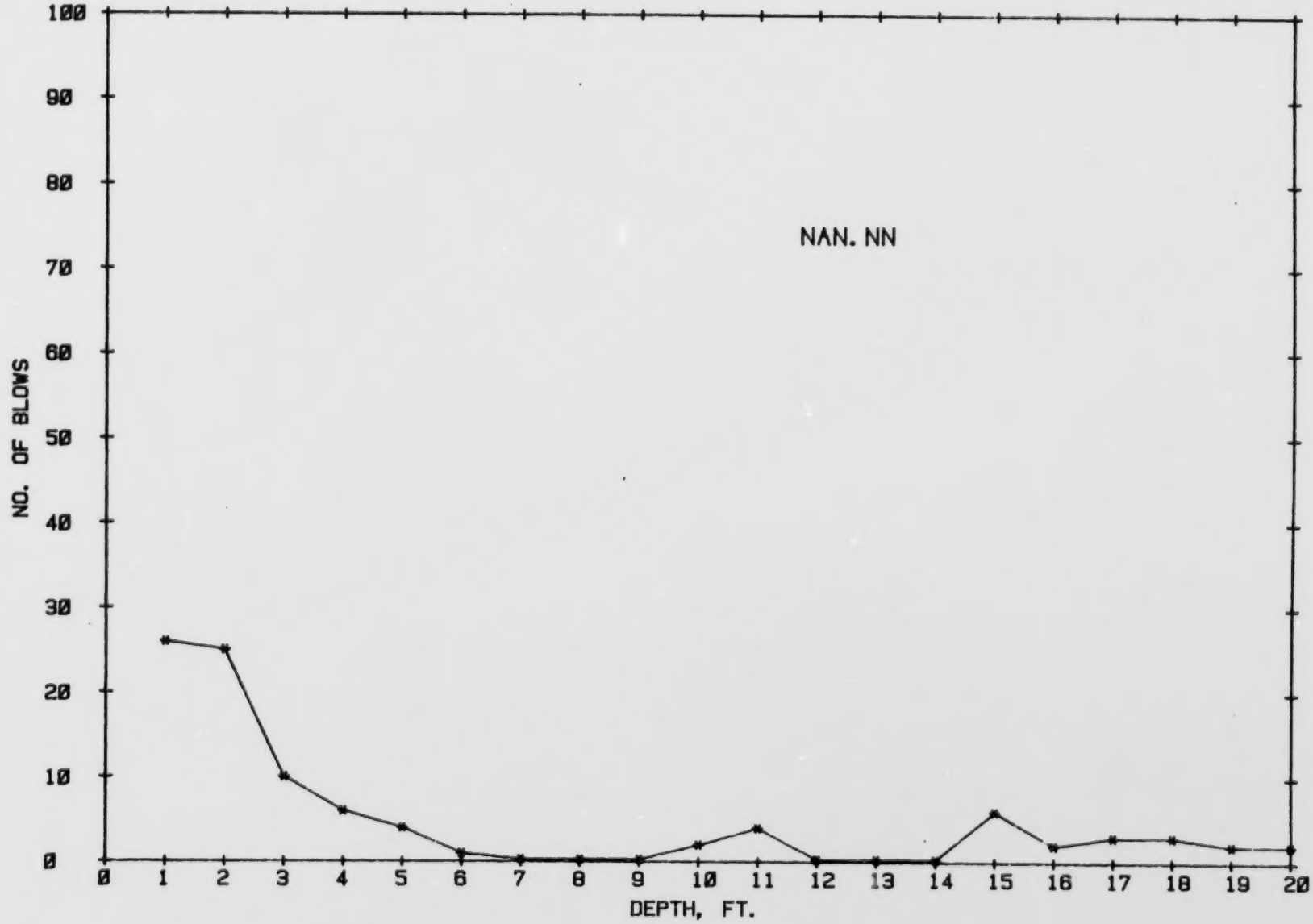
NAN. NN
NO. OF BLOWS
DEPTH, FT.
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0
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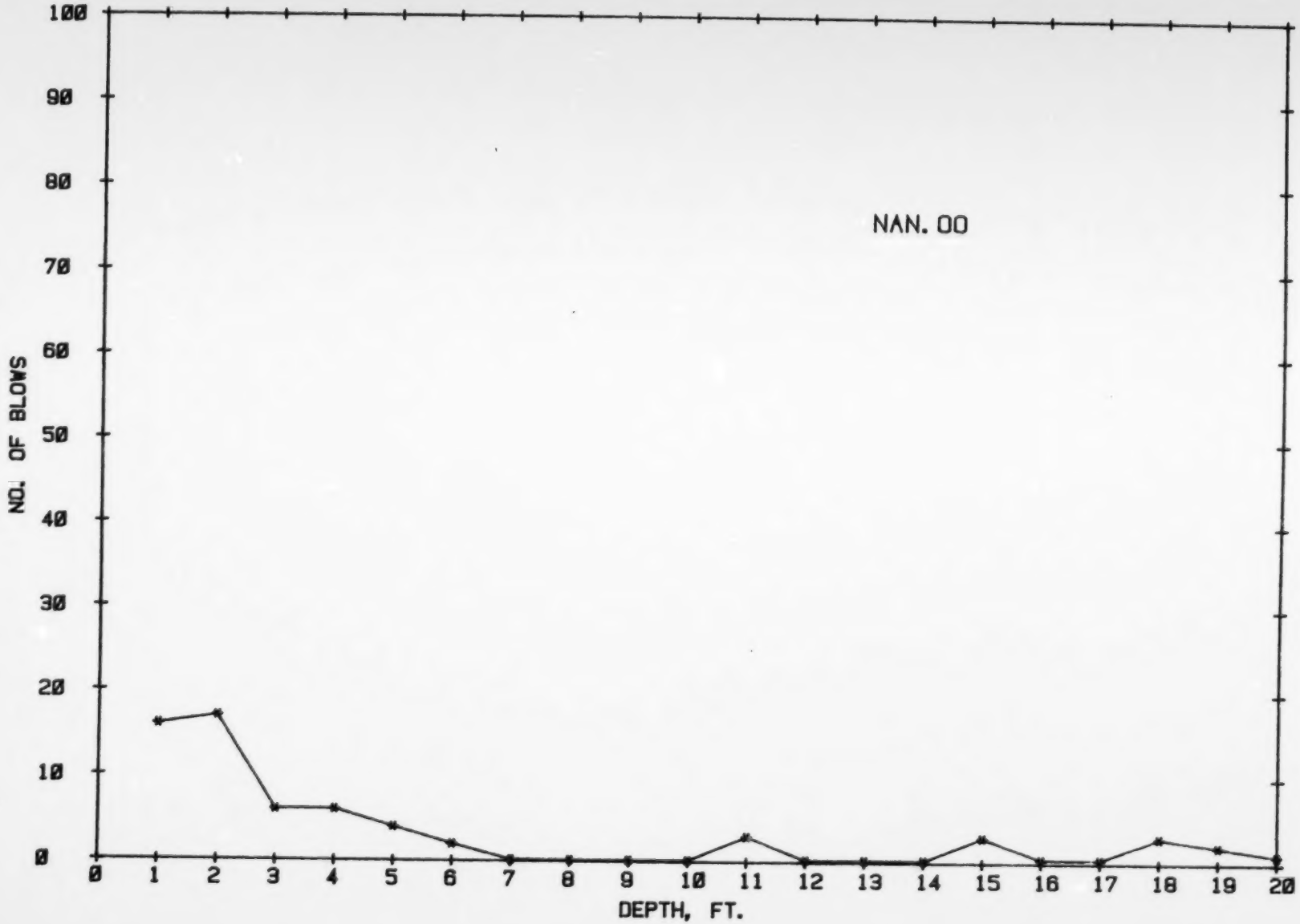
NAN. 00
NO. OF BLOWS
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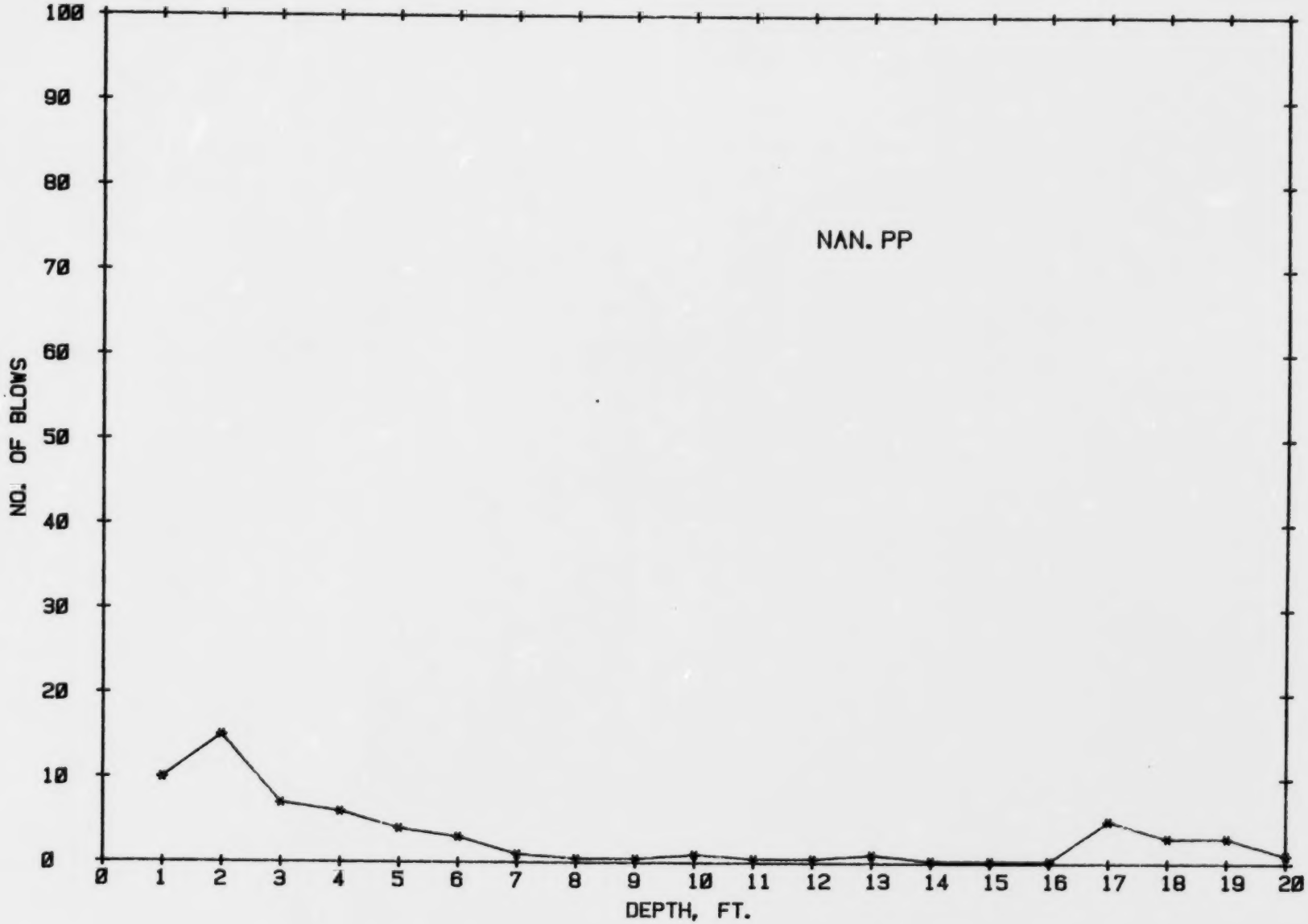
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. PP
NO. OF BLOWS
DEPTH, FT.
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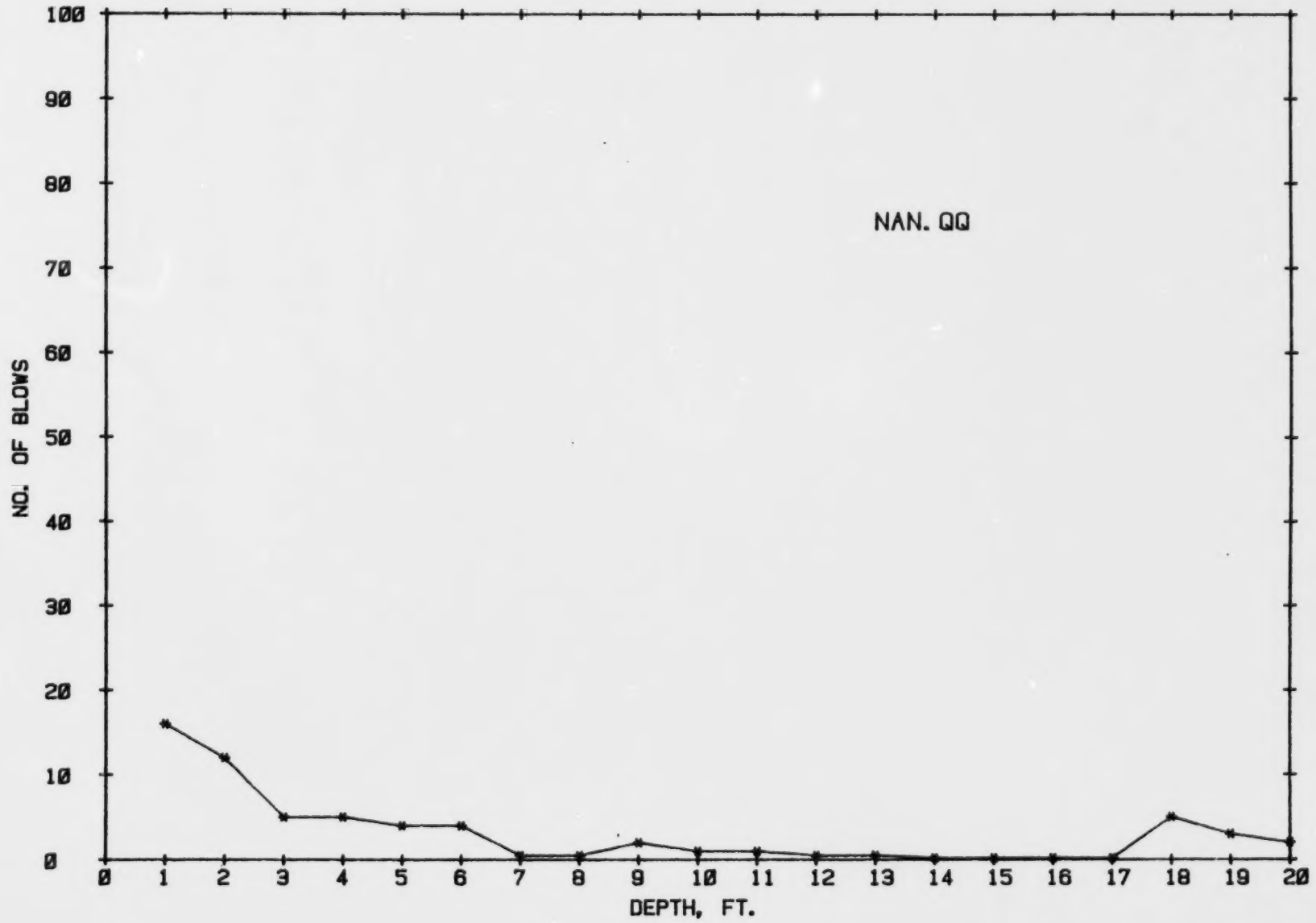
NAN. QQ
NO. OF BLOWS
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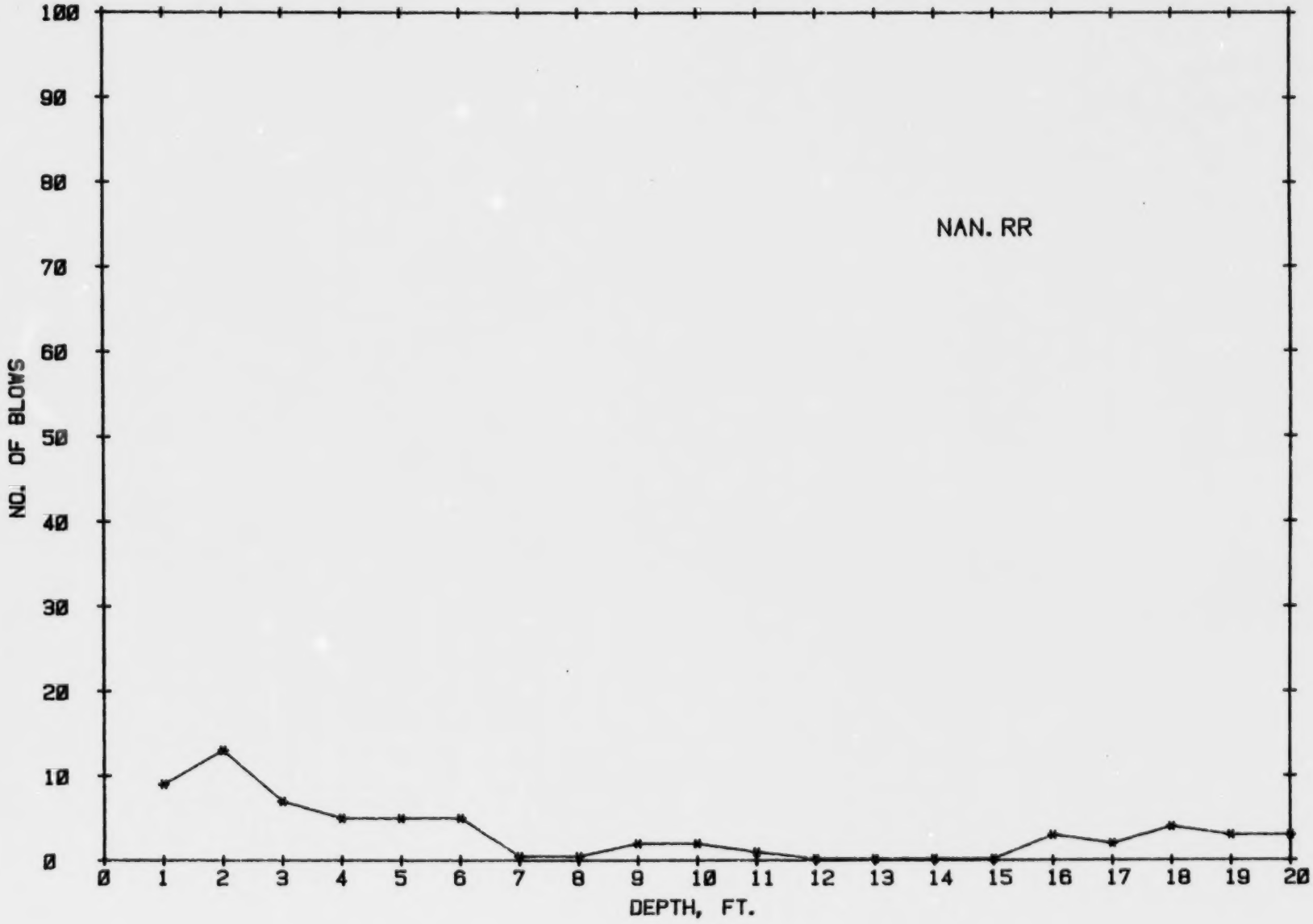
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. RR
NO. OF BLOWS
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40
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20
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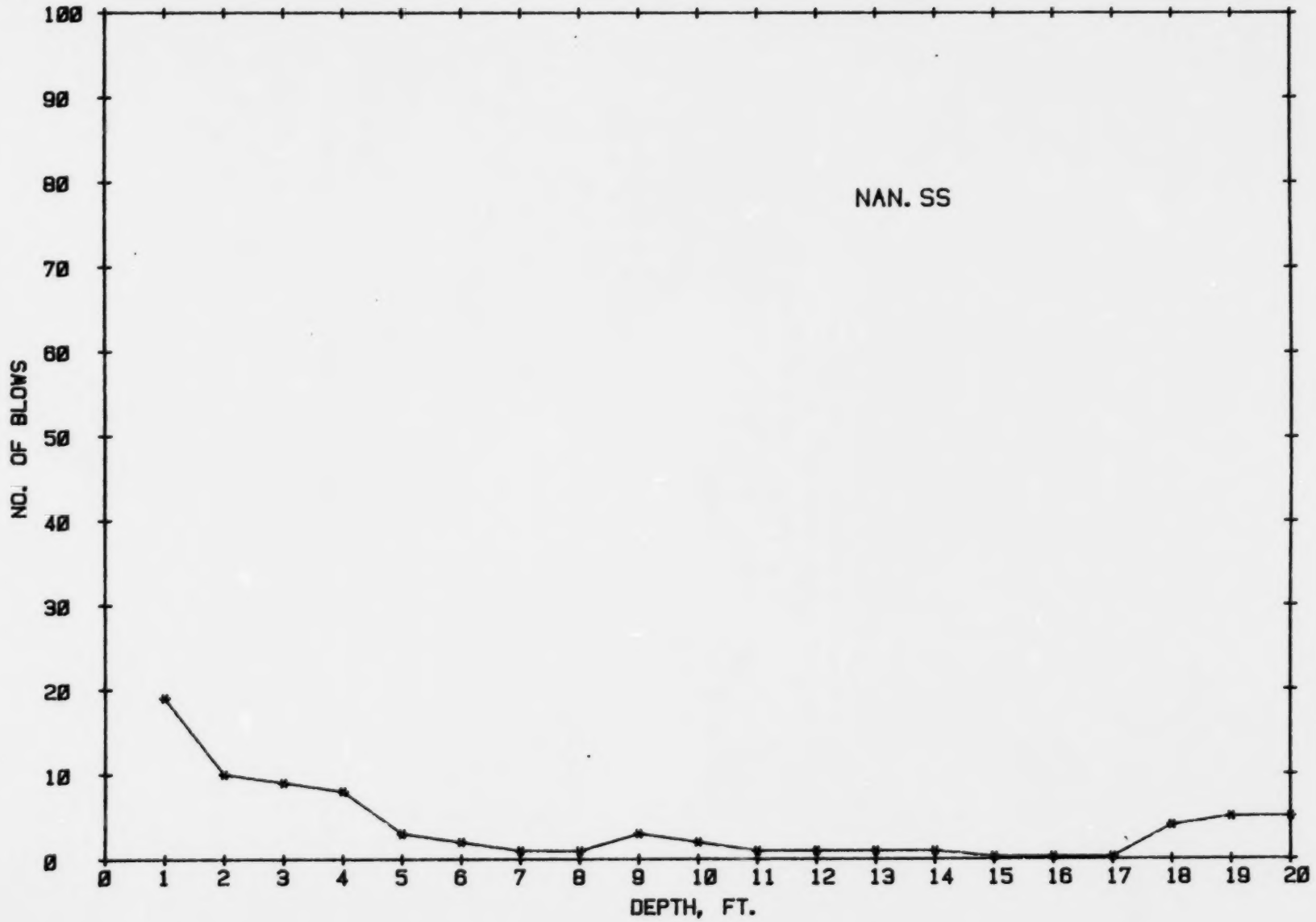
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.


NAN. SS
NO. OF BLOWS
DEPTH, FT.
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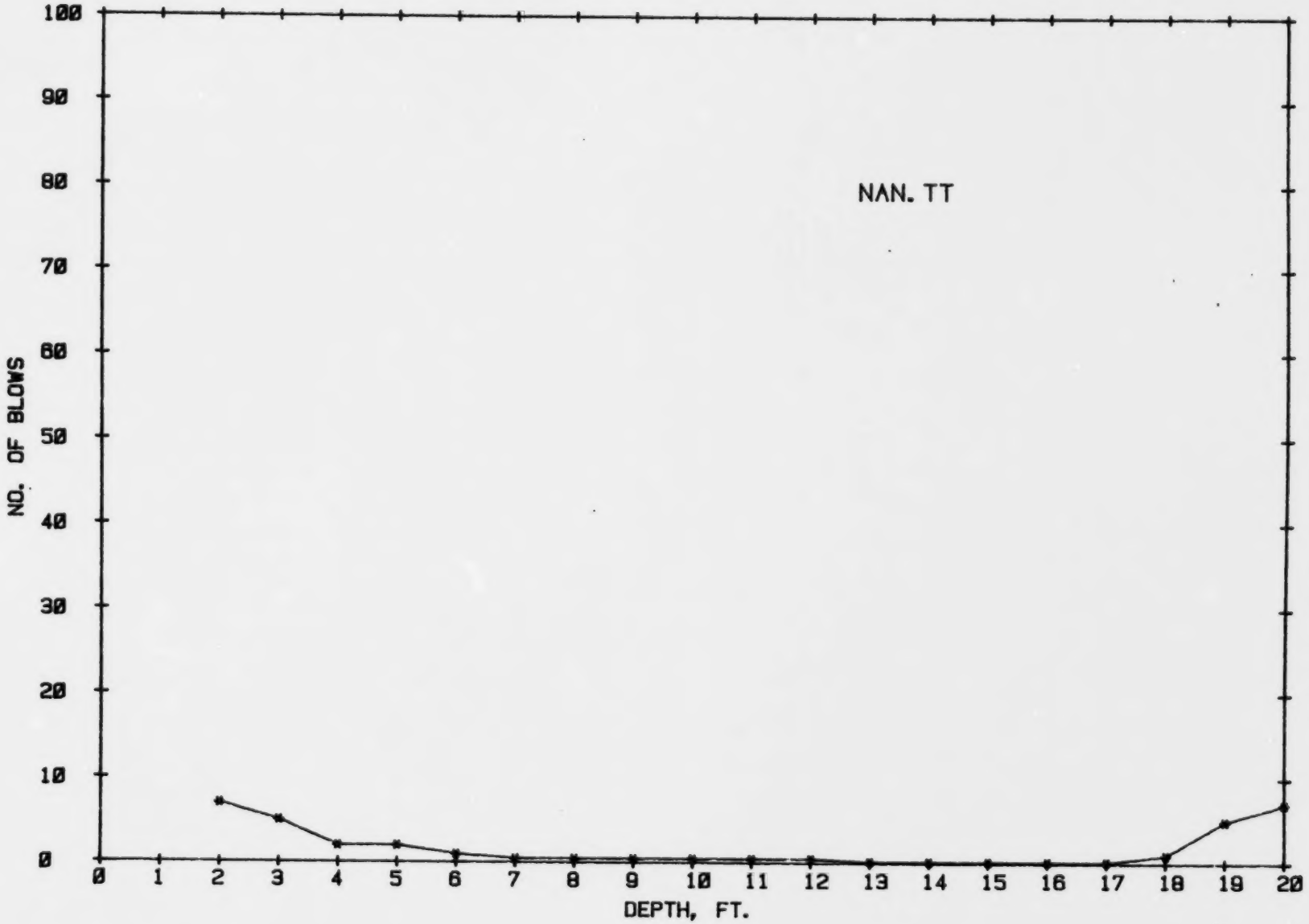
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20


NAN. TT
NO. OF BLOWS
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60
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40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DEPTH, FT.